"FUNCTIONAL OUTCOME OF DISTAL RADIUS FRACTURES WITH PERCUTANEOUS PINNING AND PLASTER IN POSTMENOPAUSAL WOMEN"

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IN

ORTHOPAEDIC SURGERY BRANCH - II

THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY

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DECLARATION

I, Dr.Ajay Karthick.V declare that the Dissertation titled ***"FUNCTIONAL OUTCOME OF DISTAL RADIUS FRACTURES WITH PERCUTANEOUS PINNING AND PLASTER IN POSTMENOPAUSAL WOMEN***" submitted to the Dr.MGR medical university Guindy, Chennai is an original work done by me during the academic period from July 2014-July 2015 at the Department of Orthopaedics, Coimbatore Medical College Hospital, Coimbatore, under the guidance and direct supervision of **Dr.S.Vetrivel Chezian, MS Ortho, FRCS, D(Ortho)** in partial fulfilment of the rules & regulations of the Dr.MGR Medical university for MS Orthopaedics post graduate degree.

All the details of the patients, the materials and methods used are true to the best of my knowledge.

I assure that this dissertation has not been submitted to or evaluated by any other Medical University.

Dr. Ajay Karthick .V

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I am also thankful to all my colleagues and staff members of the Department of Orthopaedics and radiographers who helped me in all possible ways.

CERTIFICATE

This is to certify that this dissertation titled "***FUNCTIONAL OUTCOME OF PERCUTANEOUS PINNING AND PLASTER FOR DISTAL RADIUS FRACTURES IN POSTMENOPAUSAL WOMEN"*** submitted to the Tamil Nadu Dr.M.G.R. Medical University, Chennai in partial fulfilment of the requirement for the award of M.S Degree Branch – II (Orthopaedic Surgery) is a bonafide work done by ***DR.AJAY KARTHICK.V,*** under my direct guidance and supervision in the Department of Orthopaedic Surgery, Coimbatore Medical College Hospital, Coimbatore during his period of study from July 2014 to July 2015.

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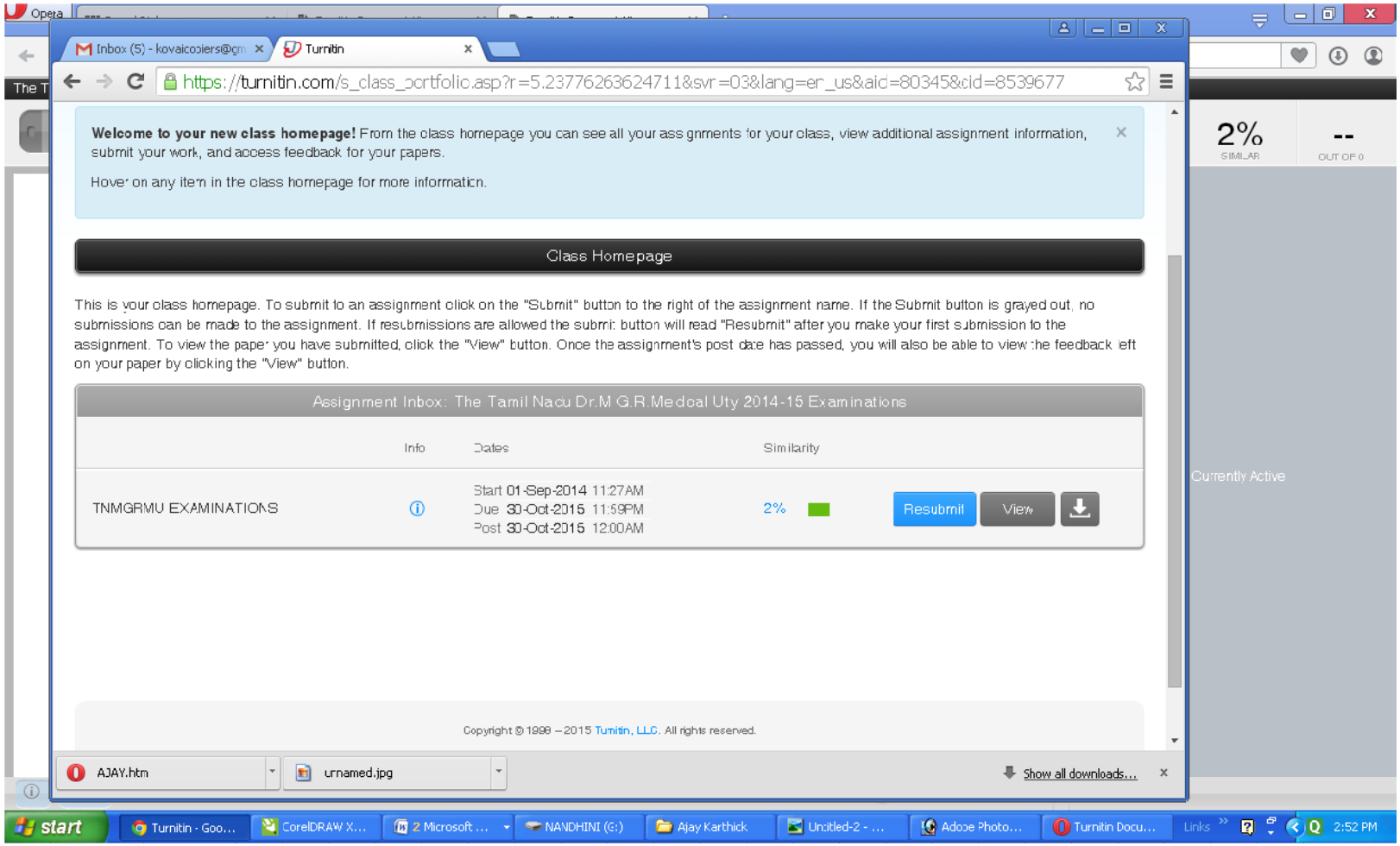
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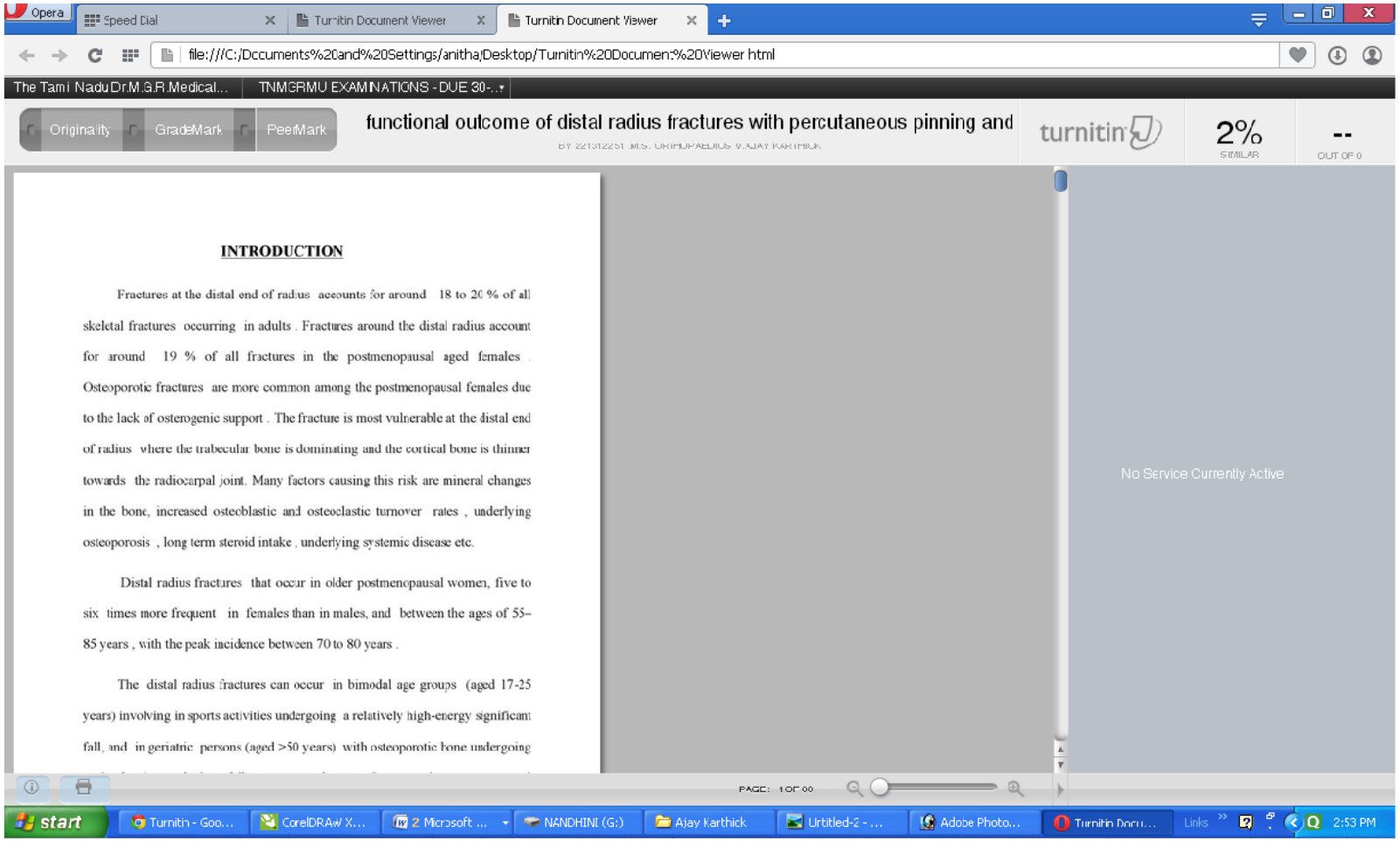
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INTRODUCTION
Fractures at the distal end of radius accounts for around 18 to 20 % of all skeletal fractures occurring in adults . Fractures around the distal radius account for around 19 % of all fractures in the postmenopausal aged females . Osteoporotic fractures are more common among the postmenopausal females due to the lack of osterogenic support . The fracture is most vulnerable at the distal end of radius where the trabecular bone is dominating and the cortical bone is thinner towards the radiocarpal joint. Many factors causing this risk are mineral changes in the bone, increased osteoblastic and osteoclastic turnover rates , underlying osteoporosis , long term steroid intake , underlying systemic disease etc.
Distal radius fractures that occur in older postmenopausal women, five to six times more frequent in females than in males, and between the ages of 55–85 years , with the peak incidence between 70 to 80 years .
The distal radius fractures can occur in bimodal age groups (aged 17-25 years) involving in sports activities undergoing a relatively high-energy significant fall, and in geriatric persons (aged >50 years) with osteoporotic bone undergoing
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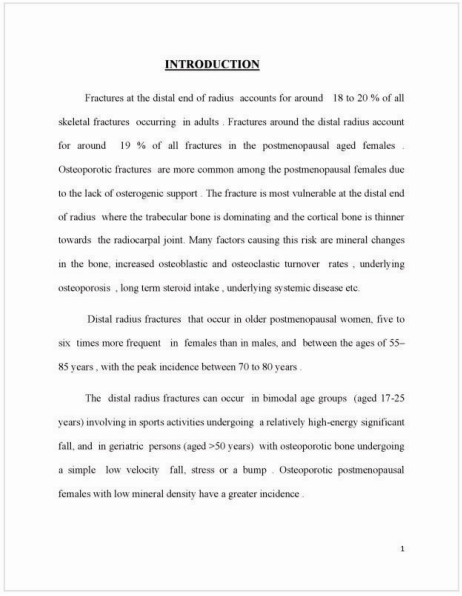

INTRODUCTION

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CONTENTS

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AIM AND OBJECTIVES

AIM

The main aim of my prospective study is to determine the" functional outcome of Percutaneous pinning for distal radius fractures in post menopausal women' .

OBJECTIVES

1. To analyse the role of minimal invasive surgical technique for distal radius fracture among post menopausal women.

2. To evaluate the functional outcome of percutaneous pinning with conservative methods.

3. To evaluate the role of percutaneous pinning as day care procedure.

HISTORICAL ASPECTS

During ancient times over the period of **Hippocrates and Galen**, distal radius fractures (DRFs) was considered to be simple wrist fracture dislocations. But **Claude Pouteau** (1725–1775) the famous French lithotomist first varied from these thoughts as he described about forearm fractures in the French literature, including a distal radius fractures. On behalf of him, distal radius the French people coined it as pouteau fractures[1] .

Next an Irish surgeon **Sir Abraham Colles** in volume of *Edinburgh Medical Surgical Journal* described distal third radius fractures. Before the invention of radiography he made a brief accurate description about the distal radius fractures based on just he clinical examinations. On behalf of his contributions, british people termed this as - colles fractures[1].

John Rhea Barton (1794-1871), orthopaedic surgeon worked in Pennsylvania Hospital in Philadelphia (United States of America) described about the fractures with intraarticular involvement that was later termed as volar and dorsal barton fractures.

Robert William smith (1807-1873) Irish surgeon decribed about the smith fractures. French speaking world called it as the "***Goyrand***

Fracture" after the famous French orthosurgeon **Jean-Gaspar-Blaise Goyrand** (1803–1866) who made excellent papers for distal radius anatomy and mechanism causing individual fractures.

British Orthopaedic Surgeon, **Jonathan Hutchinson** (1828–1913) described the fracture involving the radial styloid process with intraarticular extension and displacement.

In 1951, **Gartland and Werley** published a detailed evaluation and classification system based on metaphysical comminution, intra-articular extension and displacement.

In 1959, **Lidstrom** outlined a classification based on fracture line, direction and degree of displacement, extent of articular involvement and involvement of DRUJ.

In 1965, **Older** proposed a classification that incorporated radial shortening as variable in classification.

In 1967, **Frykman** identified the importance of ulnar involvement and publish a classification based on involvement of radiocarpal and radioulnar joints and the ulnar styloid fracture.

In 1984, **Melone** heralded the contemporary era of classification by stressing the careful delineation of 4 components of radio carpal joint namely radial shaft, radial styloid, dorsal medial and volar medial fragments.

In 1993, **Fernadez** classification was introduced, which was designed to be practical, determine stability, include associated injuries and provide general treatment recommendations.

External fixation was first described by **Anderson and O' Neil.** Practice involving bridging devices were described **by Oddly**,. The first report of by **Ombredanne** in 1930 described distal radius external fixation with the use of a nonbridging device[1].

LITERATURE REVIEW

Sebastian V. Gehrmann, MD, Joachim Windolf, MD, Robert A. Kaufmann (march 2008).

"Functional outcome of distal radius communited fractures with percutaneous pinning in low and high demand groups'. Study was done in about Forty-one patients with average age of 65 years and were reviewed. The patients into segregated into low-demand groups and high-demand groups. The study results suggested that the k- wire management of distal radius fractures in elderly patients had a good functional outcome.

Uzzaman KS (2005)

"Comparative study of conservative versus Percutaneous Pinning for Comminuted Distal Radius extra and intraarticular Fractures "study involves postmenopausal women of 35 to 70 age group. A study was done in with unstable Frykmann type III-VIII distal radius fractures for Forty patients resulting from a trivial fall. The results proved that best anatomic reductions, radiological parameters and the mayo functional outcome scores were obtained by percutaneous pinning than plaster alone .Stability of the reduction was maintained and the chances of

redisplacement and further fracture collapse is also less with percutaneous pinning [2].

Gupta, Rakesh, MS; Raheja, Anil, MS; Modi, Umesh, (Jul 1999)

"Randomized prospective comparative trial study of percutaneus cross pin fixation and plaster in functional position versus conventional plaster of paris immobilization. Study done with 50 patients comparing the ability to maintain anatomical reduction and early mobilization. The anatomical reduction with acceptable criteria and functional outcome mayo score results were statistically significant for percutaneus crossed configuration of pin fixation than the plaster cast at final 1 year follow up[3]

MD Sanjiv H. Naidu , MD John Capo .T(1997)

"A prospective randomized study on k -wire pinning for the distal radius fractures". This was a biomechanical study. Extra-articular distal radius fractures that are fixed with percutaneous pinning were biomechanically tested. Radial styloid process was fixed with two parallel pins towards the medial cortex and placement of a another crossed pin from the ulnar end of the radius towards the radial intact cortex. Results showed that the percutaneus crossed pin configuration formed the stable construct resisting shear stress, torsion stress and bending stress [4] .

Munson, Gregory o. M.D.; Gainor, Barry J. M.D (dec 1981)

"Prospective cohart study of percutaneous pinning in managing high velocity distal radius injury". Study period was three years in a sample of 22 patients. Crossed k –wire pin configuration of percutaneous fixation was done 16 patients had good results and excellent for five patients. One had a complication of pin site infection. He concluded that percutaneous pinning offers good results in treating instable fractures and preventing further collapse[5]

Cherian Jacob (2014)

"A randomized prospective trial of functional outcome with percutaneous Pinning for displaced radial fractures". Study sample was 15 patients. Patients were followed for period of 5 months. MAYO scoring was used to assess functional outcome. Study concluded with good and excellent results in 33 % of pinning group and good functional outcome in 60 % patients. Radiological parameters were maintained in 94 % cases. Pinning with atleast 5 k wires were done and an additional pin for ulna was also applied in this study [6].

Prof . Azzopardi MD (Jan 2005)

"Randomized prospective comparative study of Unstable extra-articular distal radial fractures by plaster versus plaster with additional pinning". Patients fixed with intrafocal k –wire had good radiological parameters of radial inclination, radial height, radial shift, palmar tilt compared to plaster alone after 1 year follow up. long term functional outcomes were almost similar percutaneous pinning is an excellent tool to reduce and fix unstable fractures [7].

T. C. Wong Y. Chiu .

“Comparative analysis of plaster of paris with k wire pinning for treatment of displaced extraarticular fractures among the postmenopausal chinese patients. A randomised controlled study trial by comparing the conservative verses pinning in terms of radiological and clinical functional outcome was done . results were based on mayo wrist score. The statistically significant radiological parameters were obtained in k wire group. But time duration for callus / healing and complications of stiffness, secondary arthritis remains the same.

E Lenoble and A Apoil

"Comparative study of stabilising distal radial fractures between kapandji intrafocal pinning and transtyloid pinning"- A prospective study on 96 patients by comparison between trans -styloid and Kapandji fixations for displaced extra-articular and intra-articular die punch fractures. After Kapandji fixation patients had symptoms of reflex sympathetic algodystrophy and had early wrist motion . The anatomical reduction were better in kapandji technique and radiological parameters were also good than fixed through trans- styloid . But longterm followup produced similar results of functional outcome.

M.Akhter Baig(2008)

"Fixation of wrist distal radius fractures by intrafocal pinning in adults " Study sample was large with 33 patients. Patients with intra articular or extra articular displaced Colles fractures were fixed with k-wires. The procedure was done according to kapandji technique and k-wire were fixed in basket formation without additional plaster. Concluded that minimally invasive and better stabilization of fracture with k wire and less chances of further redisplacements. Weiland's criteria were used to access radiological and functional outcome [8].

Shankar NS, Craxford AD

"Comparative study of Percutaneous pinning for communited distal end radius fractures fixed by Depalma procedure with conservative plaster treatment and their functional outcome" study were done in patients with communited radial fractures with intraarticular extension and subsequently followed up for average period of 6 months. Both the groups were analysed for radiological parameters and range of motion . Radial height and radial inclination were maintained in k –wire group and near maintenance of anatomical reductions in this group[9].

Prof .Habernek and Weinstabl

"Modified K - wire pinning for unstable distal end radius fractures and anlaysed for anatomical reductions, reduction technique and following outcome results". Modified percutaneous kuntshner -wire pinning was done for fixing unstable distal radius fractures in 34 patients is presented. Procedure includes 3 to 4 k wire fixation and all the dorsal, volar and displaced fragments were fixed. He concluded that percutaneous pinning prevents further fracture collapse under torstional and bending stress. Bending and counter blowing the k wires at the end of styloid process provides additional rotational stability. Functional outcome scores were according to Green and o'brien scale and the results were excellent in 66% , good for 21% patients , and fair for rest 9%.

T. Mah M.D and R. N. Atkinson M.D

"Stabilization of Colles fractures with Percutaneous K- wire pinning and plaster cast" study was conducted with 32 osteoporotic unstable Colles fractures. They were fixed with 2 percutaneous k – wires from lateral radial styloid base the medial cortex assuming parallel or divergent orientation after closed reduction of the fractures and immobilized with. Results showed that about 3 patients had redisplacement and fracture collapse due to inadequate reduction. There were no radial nerve injury or pin tract infection complications[10].

Greatting MD, Bishop AT

"Functional outcome of unstable irreducible distal radius fractures treated by modified Intrafocal (Kapandji) k –wire pinning". Study conducted in around 30 patients. and functional scoring was done. Results showed that intrafocal k –wire pinning guides for excellent manipulative reduction and is more suitable for patients less than 65 years. The procedure is a simple and cost beneficial. Functional were excellent in 82 percent patients .

Ruschel, Paulo Henrique ; Albertoni , Walter Manna .

"Modified Kapandji treatment Method for irreducible Unstable Extra-articular Distal Radius Fractures through intrafocal pinning". The intrafocal pin was used as a joystick to reduce and maintain the fracture. AO classification system was employed and the Gartland and Werley functional assessment was made. Results of the study showed that excellent and good after in 72% patients after 3 months and after 6 months follow up score moved to results 89% and at 12 months the scores were 96%.

ANATOMY

There is a unique anatomy for the distal third of radius. The triangular biconcave distal articular surface of radius is biconcave is completely covered with smooth hyaline cartilaginous tissue. This smooth articulating distal radial surface is further divided into two facets by a median ridge in the centre. They are a quadrilateral medial facet and a triangular lateral facet [11].

The triangular, biconcave **carpal articular surface** which is smooth is been divided by a small ridge in the posteroanterior direction into two parts. The lunate bone articulates with the medial, quadrilateral facet and the scaphoid bone articulates with the lateral triangular facet[11].

The distal end of radius articulating with the ulnar surface has a sigmoid cavity called the ulnar notch. The ulna articulates with the sigmoid notch and the surface is smooth, narrow, concave. A prominent ridge separates these two articular surfaces . A Triangular articular disk is attached to the base of this ridge . The distal radioulnar articulation is separated from the wrist joint by this articular disk[11].

There is a predominant ulnar and volar sloping at the distal carpal articulating surface and this is evident during power grasp during which there is a ulnar deviation of the wrist to hold the objects and also making

the carpal bones to slope in that direction. But the ligamentous attachments around usually will resist this carpus sloping to occur naturally.

The principle movements of wrists which include flexion; extention ; ulnar and radial deviation occurs at this distal articular radiocarpal surface. The articular radiocarpal surface forms the main load bearing column for the stress transmission to the carpus[11] .

The radiocarpal surface under the circumstances of severe compressive loads fails at the ridge junction of the articulating facets and leads to a coronal split of fracture exiting at the ridge. Further severe compressive loads leads to the shear stress and with impaction . When the compressive loads exits at the level of the scapholunate ligament it produces styloid process fractures with intercarpal ligament injury

The **medial surface** of the distal radius, articulating with the ulna head covered with smooth hyaline cartilaginous tissue forms a semicircular notch. This articulation of radius around the ulnar axis provides the pivot around which the radius swings producing supination and pronation of forearm.

There are three non-articular surfaces over the distal end of the radius

1. Volar,
2. Dorsal,
3. Lateral.

The rough and irregular **volar surface** of the bone is flat, broad, volar radiocarpal ligament is attached to this surface which prevents

volar displacement of carpus . Long Flexor tendons and neurovascular structures are arranged over the volar surface flaring of metaphysis distally with thinner cortices dorsal and radial explains the fracture displacement dorsolaterally[12].

The convex **dorsal surface** provides attachment to the dorsal radiocarpal ligament and prevents dosal displacement of carpus and the surface is irregular . It has three grooves.

The first broad and shallow radial most groove is separated divided by a prominent elevated ridge; tendon of the Extensor carpi radialis brevis passes medial to this ridge and the Extensor carpi radialis longus tendon passes laterally .

The narrow and deep second pointed ridge is the next groove radially and is sloping tangentially and allowing the Extensor pollicis longus tendon to pass through it .

The third broad medial groove is allows the tendons Extensor digitorum communis & Extensor indicis to cross through [12].

The rough **lateral surface** has a triangular projection sloping downwards called the styloid process. The tendon of the brachio radialis gets inserted and the orgin of radial collateral ligament is over

this lateral surface. The Abductor pollicis longus and Extensor pollicis brevis tendons crosses by a groove over the lateral surface of this process.

The lateral view shows the radial styloid process being volar to the mid-axis of the radius.

A Volar Radial tuberosity and volar radial ridge is seen over the lateral surface providing attachments for the pronator quadratus muscle.

Ossification : The distal radius is ossified from one primary centers. Other radial centres are located over redial head and over the shaft. The physis is fused at the second decade over the distal radius .

The radial sensory nerve lies very close to the radial styloid process and divides below the brachioradialis tendon and more vulnerable to injury during fixation.

The metaphyseal flaring at the distal end transmits major axial load and provides mobility of the joint. In coronal plane, the distal radial inclination is about 21° to 25°. In lateral view the distal palmar tilt is approximately 10° to 14°.

The region between the volar radiocarpal ligaments and insertion of the pronator quadratus muscle is called the "watershed line"[12].

The **triangular fibrocartilage complex (TFCC)** attaches from the distal radial articulating facet to the ulnar styloid process base. A simple ulnar styloid avulsion fracture at the base or ruptured TFCC produces DRUJ instability. The distal radioulnar joint stability is mainly dependent on the triangular fibrocartilage complex[12].

The **radial collateral ligament (radial carpal collateral ligament)** extends from scaphoid proximal pole and trapezium to the radial styloid process. The extent of medial deviation at the wrist is determined by the radial collateral ligaments.

Distal Radioulnar joint (inferior radioulnar joint)[12] is a pivot-joint formed between articulating surfaces of radius and ulna.

The articular surfaces are connected together by ligaments:

1. Anterior Radioulnar.
2. Posterior Radioulnar.
3. Articular Disk.

The anterior Radioulnar Ligament —connects the volar border of the radial sigmoid notch to the ulna.

The posterior Radioulnar Ligament - connects between posterior radial and ulnar regions of the joint .

The Articular Disk (triangular fibrocartilage) —The articular disk is triangular shaped, located transversely , maintains the distal ends of the ulna and radius close together. Its thicker at the periphery and thinner at the centre. Its has concave superior surface articulating with the ulnar head and forms an arthrodial joint. Its concave and smooth inferior surface is articulates with the lunate and forms part of the wrist-joint. A synovial membrane covers both these surfaces.

Three-column model of the wrist joint.

The 3-column model of the distal forearm is a simple concept that aids understanding some distal radial fractures pattern and in planning internal fixation.[12]

1. The **radial column** comprises the radial styloid process and with the lateral scaphoid fossa.

2. The **intermediate column** contains the middle lunate fossa and the ulnar notch medially.

3. The **ulnar column** is made by the distal radioulnar joint, the ulnar styloid process and the triangular fibrocartilage complex.

According to Melone (1984) the intermediate column may be split into two main fragments in articular fractures: palmar ulnar fragment and a dorso ulnar fragment.

The radial styloid is separated from the shaft and from the other fragments as a single piece . Joint impaction over the styloid fragment is rare.

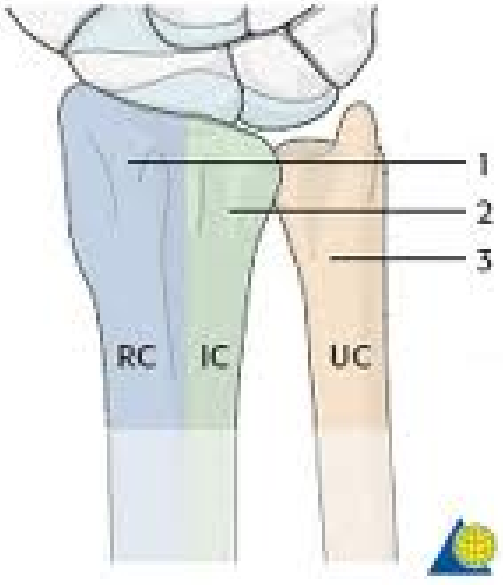
In the intermediate column, centrally impacted isolated articular fragments are present. The individual pattern of the articular fractures are best analysed using 3 dimentional CT-scan.

The biomechanical analysis describes that usually a minor load is transmitted through the medial ulnar column. The major load was transmitted across the intermediate lunate fossa columns and a little by the radial column of scaphoid fossa. This pressure area is shifted dorsally when the wrist brought into extension[13].

Radial column:. It serves primarily as a joint stabilizer and a principle mobilize of joint .A tension band mechanism usually limits medial deviation.

Intermediate column: load transmission is the primary function. Axial loads from the lunate and scaphoid are directed to carpus along this column.

Ulnar column: the main function is stabilization and load is shared and passed by the triangular fibrocartilage complex.

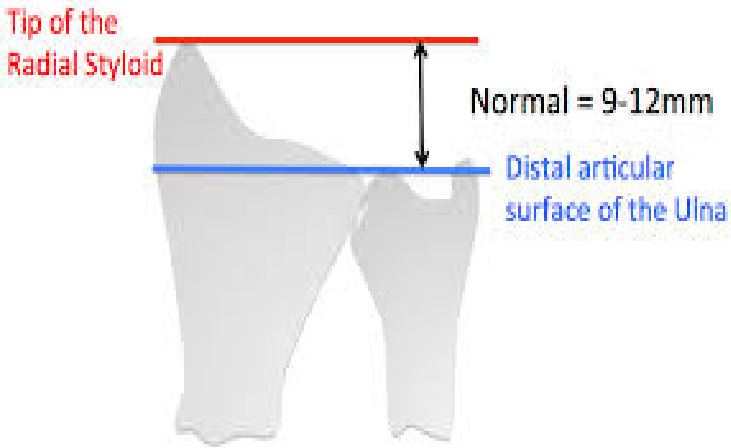


NORMAL RADIOLOGICAL PARAMETERS

Certain radiological parameters are needed to access the type of distal radius fractures and the following acceptable criteria for reduction.

Radial height (AP): is usually measured from the anterioposterior view. This represents the vertical distance between two horizontal lines, one drawn along the from the tip point of radial styloid process and the another horizontal along the distal most non articulating surface of ulna. The radial length measures normally about 10 to 13 mm [14].

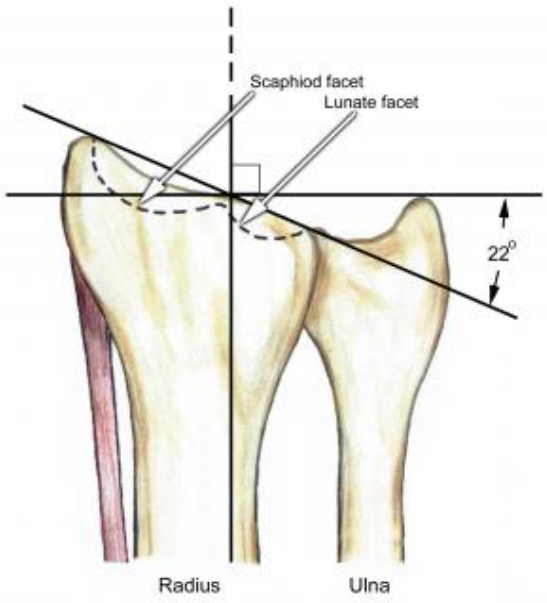
When there is excessive palmar or volar metaphyseal communition or fragmentation or impaction of the there will be loss of radial length. Less than 5 mm shortening when compared to the contralateral wrist is accepted with good functional scores. More than 10 mm shortening indicates radial head fracture.



Radial Length

Radial inclination(AP): measured in the anterioposterior view. radial inclination is formed by the intersecting angle suspended between the line connecting the distal tip of radial styloid process with the sigmoid ulnar notch and the other line along the radial axis drawn perpendicularly intersecting the previous line. The radial inclination normally ranges from 12º to º (this range may be varied). Average radial inclination is around 23º.

The Acceptable reduction of radial inclination is more than 15 degree. Any decrease in the radial inclination will produce more axial and compressive load to be transmitted along the lunate facet and may lead to secondary post traumatic osteoarthritis and decreased ulnar deviation of wrist[14].



Volar tilt (Lateral):measured along the lateral view .The intersecting angle formed by the line joining the superior and inferior lips of the radius and other intersecting line drawn with the radial axis in a lateral view.

Palmar or volar tilt normally ranges from neutral to 25º and the mean is 12º.any angle past the neutral is considered as dorsal angulation. Any dorsal angulation upto 10 degrees is accepted and the patient becomes symptomatic if the angulation exceeds this level. Disturbances in the palmar tilt may lead to decreased hand grip strength[14].

Ulnar variance: is the height of the ulnar height with respect to the radial articular surface. Normally 9 - 12mm, it is described as being zero, positive or negative and depends upon several factors including radiographic positioning. Equivocal cases should be compared with the contralateral side.

Radial Shift: measured in anterioposterior view. Represents the horizontal distance between the lateral most radial styloid point and the mechanical axis of the radius. The shift is compared to the normal side. The difference compared to the normal wrist is taken as the radial shift[14].

Intra-articular step-off : measured along the distal radioulnar and the distal radiocarpal articular surface in the anteroposterior view. articular step of more than 2 mm is considered significant. Loss of articular congruity leads to post traumatic arthritis [14].

NORMAL RANGE OF MOVEMENTS

The normal movements along the wrist are

- Flexion
- Extension
- Radial deviation
- Ulnar deviation
- Supination
- Pronation

Wrist Flexion

The pivot is around the radial aspect of triquetrum. Measured by aligning the interosseous border of ulna with the axis of fifth metatarsal along the same vertical axis. Normal range of motion is between 65-85 degrees[15].

Wrist Extension:

Similarly the pivot is centered around the radial aspect of the triquetrum of the wrist. Measured by aligning the interosseous border of ulna with the axis of fifth metatarsal along the same vertical axis .Normal Range of motion is between : 60-70 degrees[15.]

Wrist Radial Deviation:

The pivot is centered around the posterior aspect of wrist over the capitates. Measured by aligning the middle of the forearm with the axis of the third metacarpal. Normal range of motion is between 15-20 degrees. There is a hard end feel normally [15]

Wrist Ulnar Deviation:

The pivot is centered around the posterior aspect of wrist over the capitates. Measured by aligning the middle of the forearm with the axis of the third metacarpal Normal Range of motion is between 20 to 40 degrees There is a hard end feel normally .

Pronation

The pivot of motion is centered around the ulnar styloid process just radial and anterior to it. Measured by aligning the axis of ulna with the middle of the third metatarsal. Normal range of motion is between 75-85 degrees. There is a hard end feel normally [15].

Supination

The pivot of motion is centered around the ulnar styloid process just radial and anterior to it. Measured by aligning the axis of ulna with the middle of the third metatarsal. Normal range of motion is between 70-80 degrees. There is a hard end feel normally.

MECHANISM OF INJURY

Most of the distal radius injury in the post menopausal women occur by simple fall or stress or bumps. The fall on a outstretched hand produces forces that are redirected to distal end of weak osteoporotic radial bone producing fractures.

The major factors responsible for predicting the type of injury are

- Velocity of injury
- Quality of bone
- Position of wrist, forearm and hand

Colle's fractures

When the forearm is pronated and when the person falls with hyperextended radially deviated wrist compression forces are transmitted along to weak cancellous metaphyseal bone producing tensile volar cortex and compressile dorsal cortex to be fractured. Fall over pronated wrist produces typical dorsal displacement and angulation. More severe compressive stress produces intraarticular fractures.

Smith fractures

Caused by fall on an outstrched hand with forearm in supination and wrist in complete flexion. Flexion of wrist produces palmar angulation typically.

Barton fractures

Caused by shearing mechanism of injury with fall over out stretched hand with forearm fixed in pronation onto a dorsiflexed wrist producing articular fractures.

Hutchinson fractures

Caused by fall with wrist in hyperextension and ulnar deviation producing of radiocarpal ligament avulsion. There is compression the radial styloid process over the scaphoid bone producing redial displacement.

There are various theories stating the mechanism and type of injury

- Compression theory
- Avulsion theory
- Theory of incurvation.

Compression theory

During fall over hyperextended wrist produces proximal carpal bones to be in major impact surface and the proximal radial head is under the compressile stress of humerus. This causes naturally the compression to get transmitted over the distal metaphyseal zone.

Avulsion theory

Generally the volar cortex and ligaments are under tensile stress and dorsal cortex and ligaments are under compressive stress. During fall over hyper extended wrist tensile volar cortex and ligaments are avulsed causing fracture.

Incurvation theory

It states that bending forces produces most of the fractures. When the wrist is dorsiflexed the fractured distal radius causes volar ligaments to be stretched and pulling the ulnar collateral ligaments producing ulnar styloid fratures. If the volar ligament further resists the force it produces a dorsomedial fragment called die punch fragment.

CLASSIFICATION

Numerous classifications are available for the distal radius fractures.

Based on the radiological fracture patterns and displacement

1. AO CLASSIFICATION
2. LIDSTROM CLASSIFICATION
3. SARMIENTO CLASSIFICATION
4. COONEY UNIVERSAL CLASSIFICATION (1990)

Based on the mechanism of injury

1. FERNANDEZ AND JUPITER CLASSIFICATION (1987)
2. CASTING CLASSIFICATION

Based on the degree of communition involved

1. GARTLAND AND WERLY CLASSIFICATION (1951)
2. OLDER CLASSIFICATION
3. JENKINS CLASSIFICATION

Based on the articular surface involvement

1. MELONE CLASSIFICATION (1986)
2. MAYO CLASSIFICATION

AO CLASSIFICATION

23-A extra articular fracture

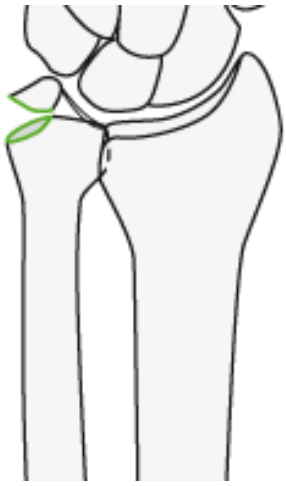
23-A1 ulna fractured, radius intact

23-A2 radius, simple and impacted

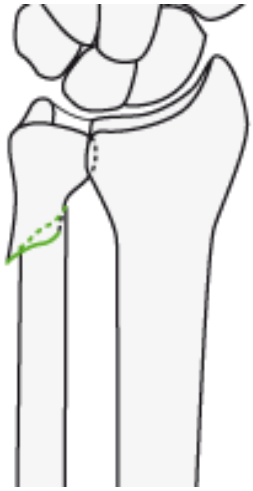
23-A3 radius, multi fragmentary

23-A1.1

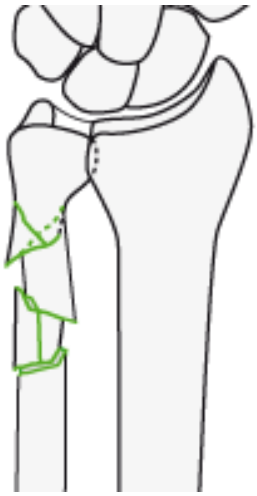
An avulsion fracture of the ulnar styloid. The radius remains intact. The ulnar styloid avulsed at its tip, through the body, or through its base (basi-styloid fracture). The level of avulsion has implications for the attachment of the triangular fibrocartilage complex (TFCC) and the DRUJ[15] .



Type 23-A1.2 fractures are simple fractures of the ulnar metaphysis,

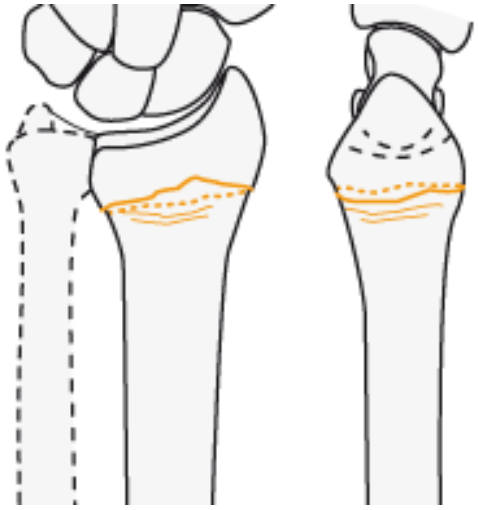


Type 23-A1.3 are multifragmentary metaphyseal fractures of the ulna.



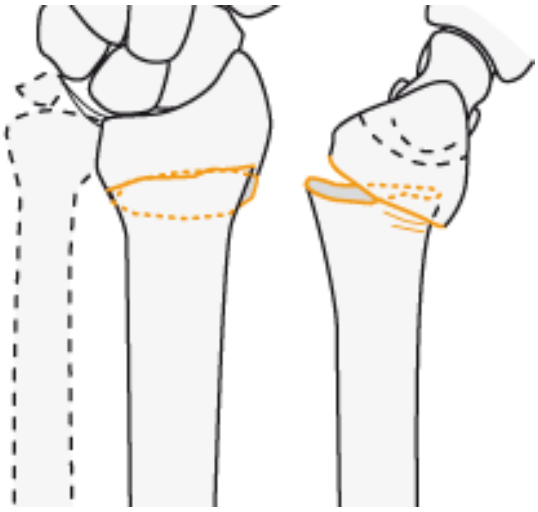
Type 23-A2.1

These fractures involve neither the radiocarpal, nor the distal radioulnar joints, affecting only the radial metaphysis. They are undisplaced, or impacted,with no abnormal palmar or dorsal tilt[15].



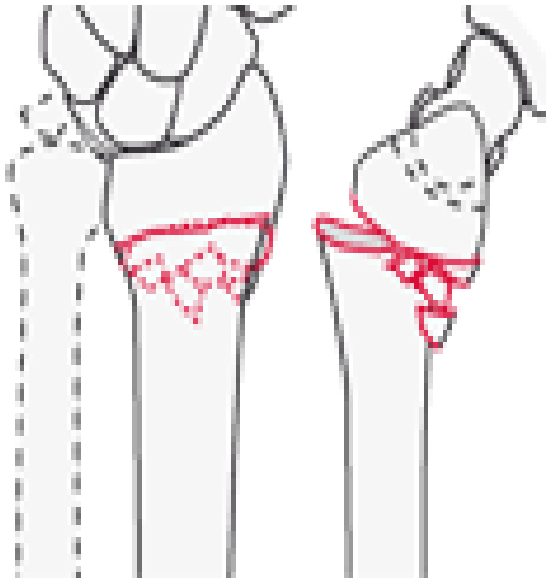
Type A2.2

Simple extraarticular fractures with impaction and dorsal tilt. These are referred to as Colle's or Pouteau fractures.



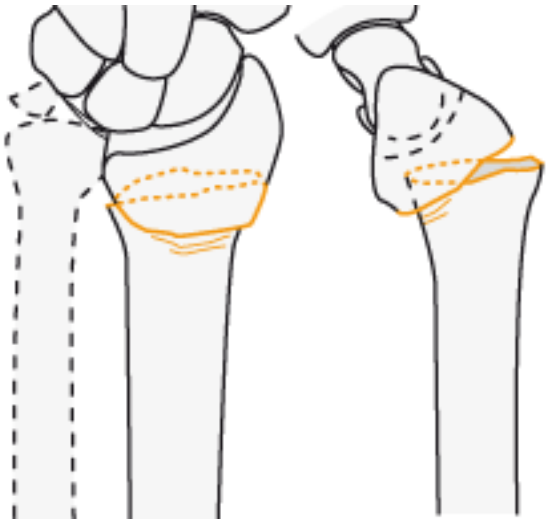
Type A2.3

Simple extraarticular fractures with a volar tilt. These are referred to Smith or Goyrand fractures



Type 23-A3

These are extra articular metaphyseal fractures, but multi fragmentary. They are sub - classified according to the degree of fragmentation and compression of the metaphysis**.**



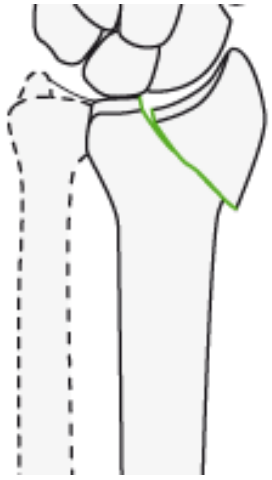
Type 23-B partial articular fracture of radius[15]

23-B1 sagittal

23-B2 coronal, dorsal rim

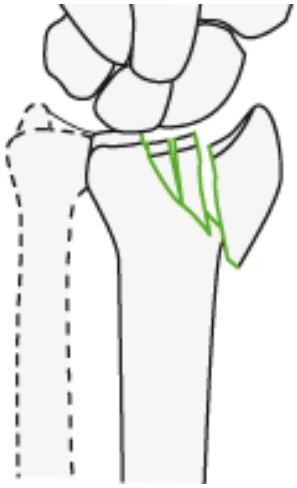
23-B3 coronal, palmar rim

Type B1.1 is a simple articular split of the radial styloid



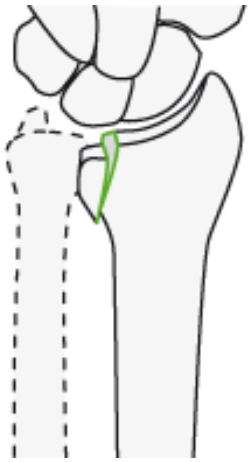
Type B 1.2

Fractures are a split of the radial styloid but with articular comminution .



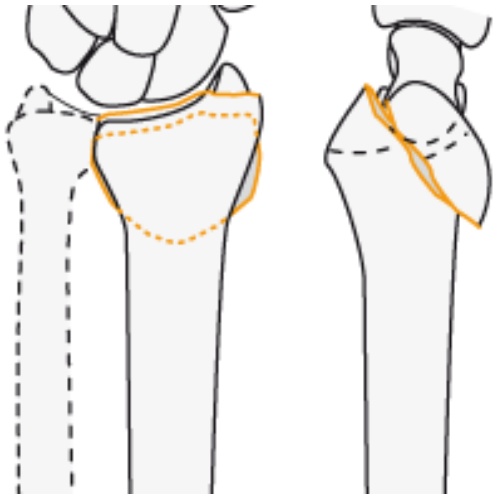
Type B1.3

Are a split fractures of the medial radial articular surface, adjacent to the DRUJ



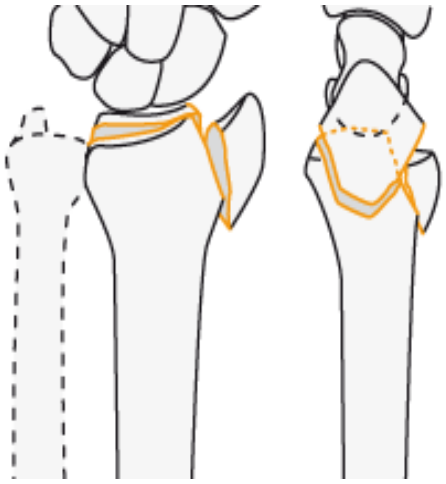
Type B2.1

A simple fracture of the dorsal rim, that is often a small fragment



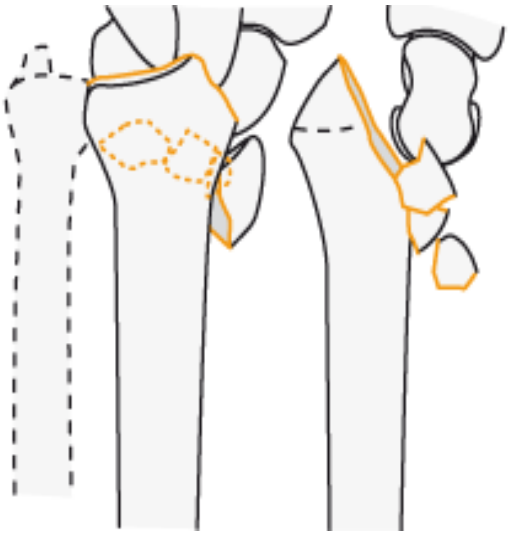
Type B2.2

The fracture of the dorsal rim is associated with a radial styloid fracture .

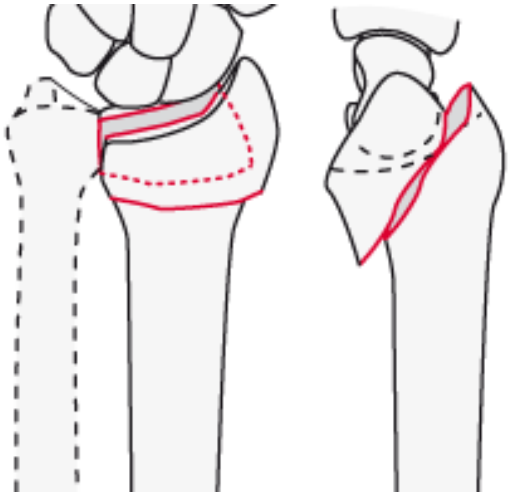


Type B2.3

The fracture of the dorsal rim is associated with a radial styloid fracture, with greater instability than in B2.2 fractures and dislocation of the carpus[15]



Type B3 fractures involve a fracture of the palmar rim, and the wrist is unstable.



Type 23-C complete articular fracture of radius

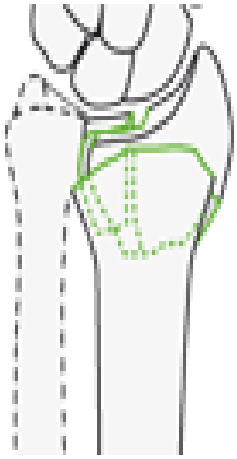
23-C1 articular simple, metaphyseal simple

23-C2 articular simple, metaphyseal multi fragmentary

23-C3 articular multi fragmentary

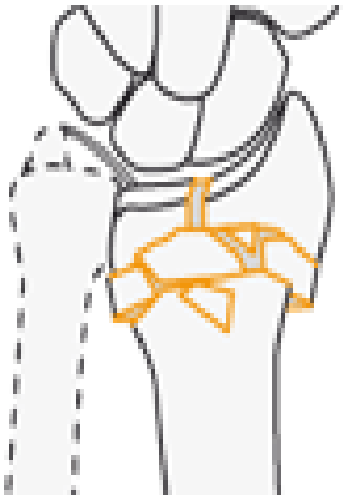
Type C1

Fractures with the intraarticular component is a single split.



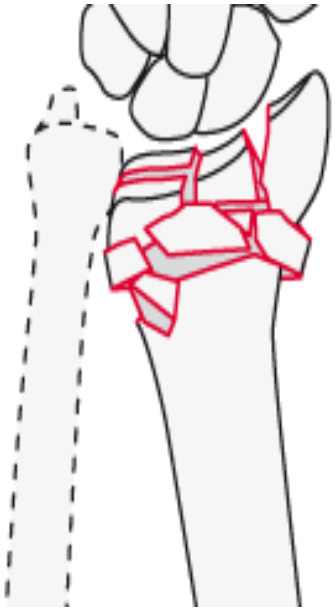
Type C2

Fractures with the intra articular component is a simple split, but the metaphyseal component is multi fragmentary.



C3 fractures

the intraarticular fracture is multifragmentary



Frykman classification

The Frykman classification accounts for anteroposterior view of distal radial fractures. Classification based on pattern of inarticular surface involement. It includes both radiocarpal and radioulnar articular fractures and the associated ulnar fractures [16].

Type I :

Includes extraarticular simple radial metaphyseal fracture. Comprises both dorsally displaced Colles and palmar displaced Smith fractures

Type II :

Includes type I injury plus ulnar styloid process fracture

Type III :

Includes partial articular fracture extending towards the radiocarpal joint.

Comprises both volar and dorsal barton fractures.

Type IV :

Includes type III injury plus ulnar styloid process fracture.

Type V :

Includes articular fractures extending towards the distal radioulnar joint only.

Type VI :

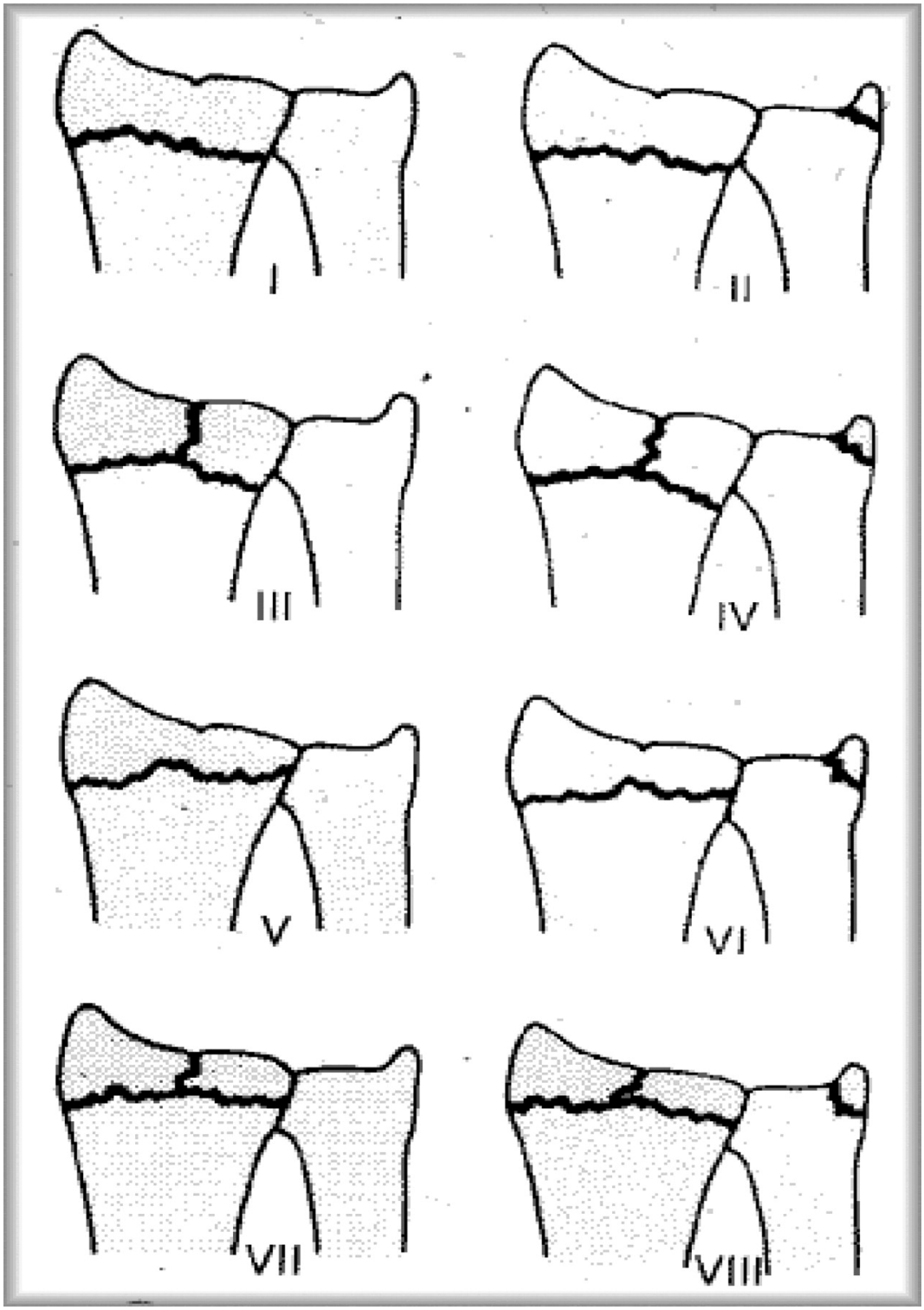
Includes type V injury plus ulnar styloid process fracture.

Type VII :

Includes severe comminuted articular fractures extending into both the distal radiocarpal and distal radioulnar joints.

Type VIII :

Includes type VII injury plus ulnar styloid process fracture.


I
II
III
IV
V
VI
VII
VIII

Jupiter and Fernandez Classification

It is a mechanism based classification [17]

1] Bending injury

The bending stress of metaphysic produces compressive stress along one cortex and tensile stress along opposite cortex which in severe cases produces communition. Colles and Smith fractures are caused by this mechanism.

2] Shearing injury

Vertical shear stress causes fractures extending towards the articular surfaces. Partial articular volar Barton's, dorsal Barton are produced by this mechanism.

3] Compression injury

Axial compressive loads leads to impaction of Fractured metaphyseal and dense subchondral bone producing dorsomedial fragment so called die –punch. In more compressive loads fractures subchondral bone procucing articular fractures.

4] Avulsion injury

Fractures over tendinious attachments of radiocarpal and ulnocarpal liganents.

5] Combination of all types

High velocity injuries producing combined mechanism of injuries

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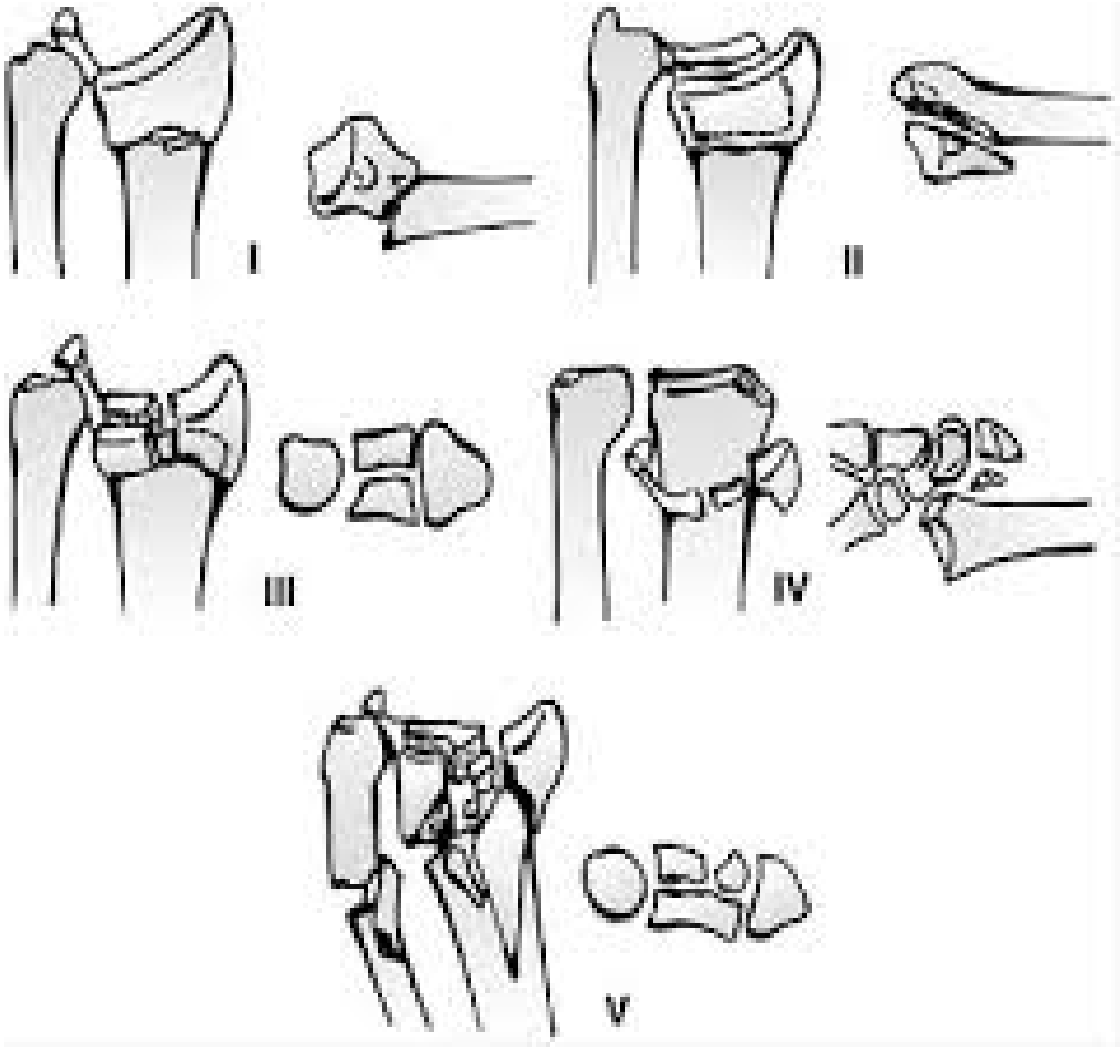


Melone classification[18]

1. **Type I:**

Stable fractures that are undisplaced without communition or with minimally comminution.

2. **Type II:**

Unstable displaced die punch fractures involving both articular surface. fractures extending over styloid process causes displacement and angulation. fractures may be volar or dorsal.

- Type II a (reducible)
- Type II b (irreducible)

3. Type III:

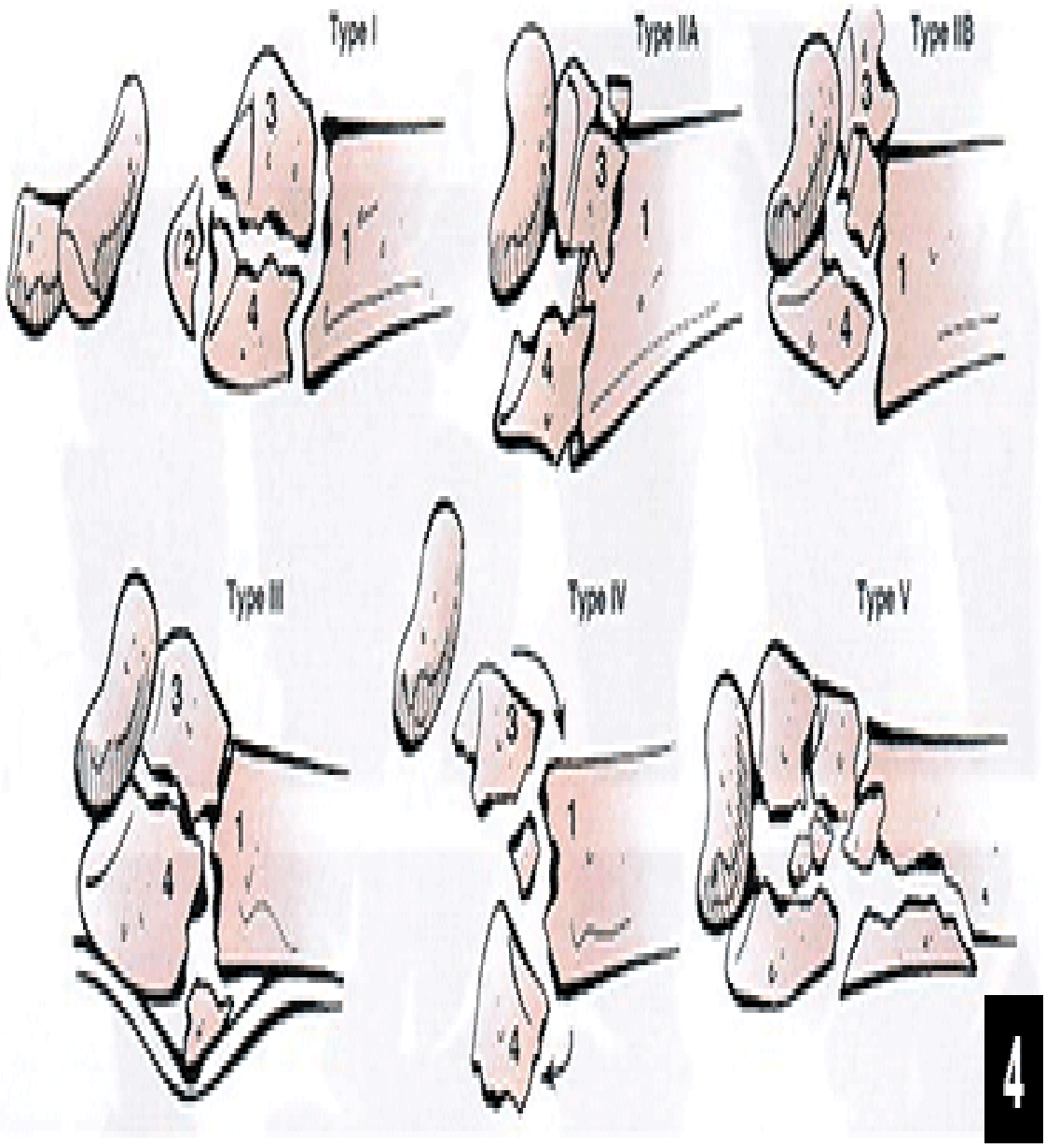
Consists of spike fractures contusing volar cortex

4.Type IV:

Split fractures with separate dorsal and palmar fractured fragments

5.Type V

Explosion irregular fractures with multiple communition and soft tissue lacerations.



4

Mayo Classification (1992)

I -Undisplaced

II - Radioscaphoid

III - Radiolunate (Die punch)

IV –Radioscapholunate

UNIVERSAL COONEY CLASSIFICATION [19]

Type I extraarticular and undisplaced fractures

Type II extraarticular and displaced

1. Stable after reduction
2. Unstable after reduction
3. Irreducible fractures

Type III intra articular, undisplaced

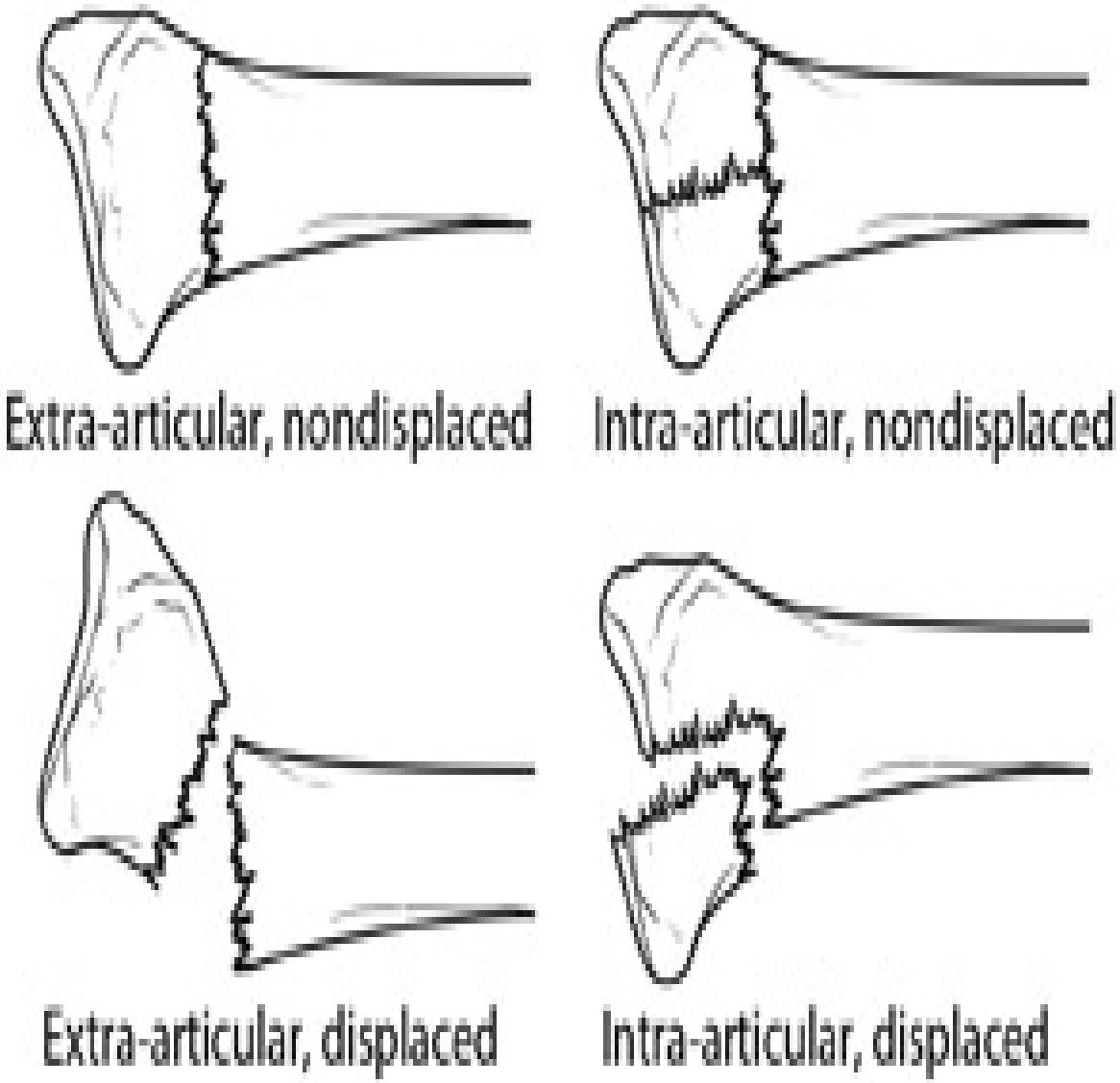
Type IVArticular, displaced

A. Stable after reduction

B. Unstable after reduction

C. Totally irreducible

D. Complex irregular injuries.


Extra-articular, nondisplaced
Intra-articular, nondisplaced
Extra-articular, displaced
Intra-articular, displaced

COMPLICATIONS OF DISTAL RADIUS FRACTURES[20]

- Median nerve neuropathy .
    - Most common neurologic complication
    - Ulnar nerve neuropathy
    - Seen with DRUJ injuries[20].

- Extensor Pollicis Longus tendon rupture
    - Lister's tubercle is the frequent site for rupture
    - Synovial thickening and increased collinear friction causes the rupture.
    - It takes about 2 weeks to 2 months following injury for the symptoms to occur.
    - Incidence or rupture is more common on undisplaced fractures than displaced fractures [20]

- Radiocarpal arthritis (5-40%)
    - Intra articular step off > 2 mm is more likely to cause radiocarpal arthrosis
    - May be symptomatic 95 percent or non symptomatic
- Malunion and Nonunion
    - Malunion involving articular surface
    - they are treated with correction and fixation procedure at less than 6 weeks

- angulation malunion over metaphyseal region
  - They are treated by corrective darrach lateral based opening wedge osteotomy with fixation and defect is corrected by autogenous bone grafting
- malunion with reduced radial length and inclination
  - radial shortening produces reduced hand grip and secondary osteoarthritis
  - they are treated by ulnar shortening procedures

- Extensor carpi ulnaris tendon entrapment
  - entrapment occurs in Distal radioulnar joint injury
- Compartment syndrome

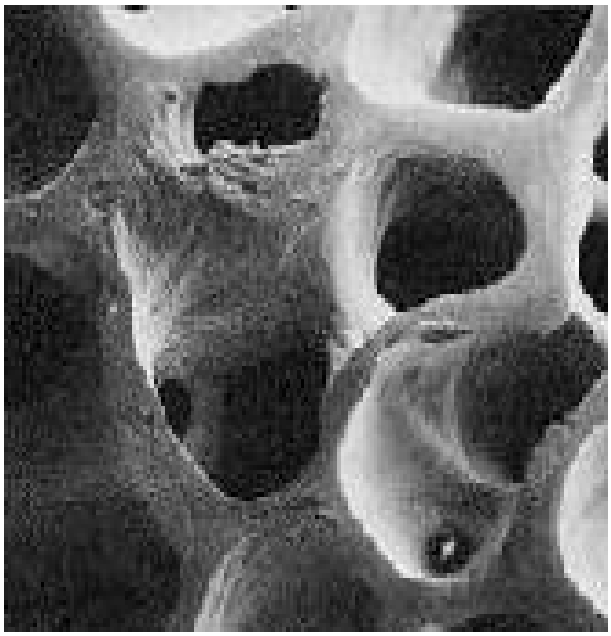
  may be acute or chronic
- Loss of reduction and Secondary deformity
- Reflex Sympathetic Dystropy /Complex regional pain syndrome
  - Wrist is stiff, painfull and there are signs of vasomotor instability.
  - RSD following colles fractures will result from over distraction.

OSTEOPOROSIS

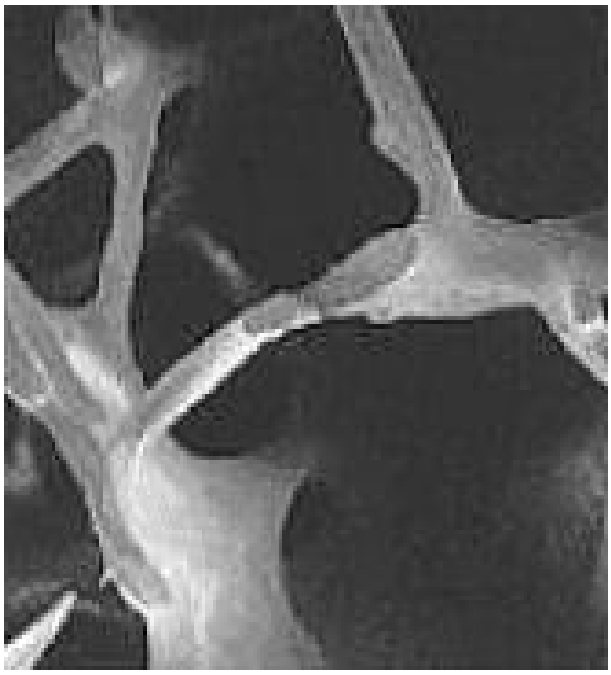
Definition :

"Systemic skeletal disease characterized by low bone mass and microarchitectural deterioration of bone tissue, leading to enhanced bone fragility and a consequent increase in fracture risk" [21]

Normal



Osteoporosis



Postmenopausal females due to the lack of osterogenic support are more prone to osteoporotic fractures. The fracture is most vulnerable at the distal end of radius where the trabecular bone is dominating and the cortical bone is thinner towards the radiocarpal joint. Fractures that are produced at the sites of osteoporotic bones is the major cause of morbidity among the postmenopausal women.

These osteoporotic fractures are usually caused by minor trivial falls or due to stress or bumps. The distal radius fractures in woman is regarded as a usefull indicator for osteoporosis and future fracture risk because of its early occurance [21].

The major sites of fracture in are

1. Distal radius
2. Proximal humerus
3. Lumbar spine
4. Femoral neck
5. Trochanteric region and subtrochanteric region
6. Proximal tibia lateral condyle

Hormonal imbalances can result in rapid bone loss in postmenopausal woman. Loss of balance between osteoclastic and osteoblastic activity leads to decreased bone mineral mass. Annually

there is upto 5 percent of bone mineral loss and the loss peaks around the menopause.

T score is calculated from the standard deviation value of the BMD matched with 35-year-old individual of the same sex.

Z score is calculated from the standard deviation score that are compared to matching standard age controls samples.

WHO defines T value score less than – 1.0 as the accepted normal

T score values between – 1.0 to – 2.5 are considered as osteopenia

Osteoporosis is defined as any T score value below – 2.5

T score value less than – 3.5 indicates severe osteoporosis

The risk of fracture doubles for corresponding 1 score decreased from T value

The T score value is most important predictor of hip fractures and subsequent fractures.

TREATMENT MODALITIES AVAILABLE

Nonsurgical Treatment

It includes closed reduction and plaster application in cotton loader position. With anaesthesia reduction is obtained by traction and counter traction decreasing impaction and aligning distal fragments in anteroposterior direction and reducing the angulation[22] .

After acceptable reduction plaster slab applied in

- Pronation ,
- Palmar flexion of 20 degree and
- Ulnar deviation of 10 degree.

After the swelling subsides plaster cast applied in reduced position .The cast removal is done after 6 weeks and wrist mobilization exercises are begun.

Surgical options

1. Percutaneus direct pinning and plaster
2. Elastic intrafocal and extrafocal pinning
3. Arthroscopic pinning
4. External fixation
5. External fixation and pinning
6. ORIF with buttress plating
7. ORIF with volar locking compression plate.

Acceptable criteria [23]

1. Less than 15 degree of dorsal and less than 20 degree palmar tilt or angulation
2. More than 15 degree of radial inclination
3. Less than 5 mm radial shortening compared with the opposite normal wrist
4. Negative or neutral ulnar variance
5. Intraarticular gap of less than 2 mm
6. Intraarticular step of less than 1 mm is needed **.**

Lafontaine's criteria[24]

1. More than 20 degree dorsal angulation
2. Dorsal cortex communition of more than 50 percent , palmar cortex communition.
3. Intraarticular communition
4. initial fracture displacement of more than 1 cm
5. initial radial shortening more than 5 mm
6. Associated ulnar styloid process or shaft fracture

Graham(1997)criteria [25]

1. Compared with the contralateral distal radioulnar joint (DRUJ), Radial shortening of less than 5 mm in involved side .
2. On a posteroanterior (PA) Radial inclination of more than 15°.
3. On the lateral view, dorsal tilt of 15 degree and 20 degree volar angulation .
4. Any Intra-articular fracture step-off less than 2 mm of the articular suface of joint

   Jupiter et al.
5. Articular incongruity of about 2mm or more is regarded unacceptable

Distal radioulnar joint reduction criteria [26]

A radiographic sign that indicates DRUJ instability, is

1] Compared to normal side widening of the distal radioulnar joint on the AP view or radioulnar distance by 6mm or more on lateral view

2] base of ulnar styloid process fracture,

3] avulsion fracture of the ulnar collateral ligaments at the ulnar facet .

4] 5 mm of radial shortening and

5] a radial inclination less than 15 °

6] dorsal angulation of more than 15 degree of the distal radius .

7] subluxated ulna on a lateral view

ADVANTAGES AND DISADVANTAGES OF PINNING

ADVANTAGES OF PERCUTANEOUS PIN IN PLASTER

1. Minimal soft tissue disruption and absence of periosteal stripping making biological advantage .
2. Adequate stable fixation preventing further displacements, fracture collapse and early motion over the wrist joint.
3. Less disturbance of fracture haematoma and chances of infection.
4. Kapandji focal pinning can used as a joy stick to manipulate and reduce both extraarticular and intra articular fractures.[27]
5. Simple day care procedure.

DISADVANTAGES

1. The radial sensory nerve is more likely to get injured around the anatomical snuff box while percutaneous pinning .
2. Too tight cast may produce compartment syndrome and cast disease.
3. Pin tract infection and pin loosening .
4. The development of secondary posttraumatic arthritis with fractures of articular surface .

MATERIALS AND METHODS

A prospective cohart study of “functional outcome of distal radius fractures with percutaneous k wire pinning and plaster application” is done in Coimbatore medical college hospital, Coimbatore.

The present study is conducted on 13 patients who are diagnosed to have distal end of radius fracture and being admitted in Coimbatore medical college hospital, Coimbatore during one year period of July 2014 to July 2015.

Detailed written Informed consent was obtained from all the patients.

Study design: An prospective cohart observational study.

The age group ranges between 45 to 65 years .

Inclusion criteria:

1. Postmenopausal women

Exclusion criteria

1. women in menstrual phase
2. children (0-14 yrs) and males
3. associated chronic co- morbidities.

Modified Mayo wrist score for assessing functional outcome

Parameter	Score
Pain	
No pain	25
Mild occasional	20
Moderate	15
Severe	0
Work status	
Regular job	25
Restricted job	20
Able to work but unemployed	15
Unable to work due to pain	0
Range of motion	
> 120°	25
100°–119°	20
90°–99°	15
60°–89°	10
30°–59°	5
0°–29°	0
Grip strength (% of normal)	
90–100	25
75–89	15
50–74	10
25–49	5
0–24	0

Interpretation

- Scores between 90 to 100 are considered excellent
- Scores between 80 to 89 are considered good
- Scores between 65 to 79 are considered Fair
- Scores between less than 50 are considered poor.

The patients were included with strict inclusion criteria without associated co morbidities like diabetes , hypertension, heart disease etc. Detailed clinical history and clinical examination is undertaken from the patient who have been admitted in Coimbatore medical college & hospital.

Anteroposterior, lateral radiographs were taken preoperatively. These were reviewed by to determine AO classification of the fracture.

The fracture pattern was also confirmed intraoperatively. In selected cases CT scan was done in order to know the extent of articular surface involved. Basic patient demographics, mechanism of injury and AO fracture classification were recorded.

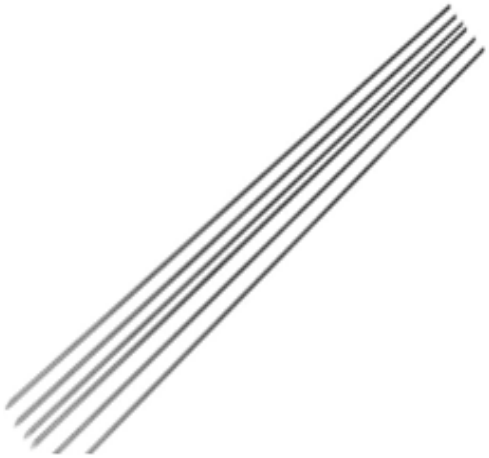
The functional outcome of patients was assessed by using modified mayo wrist score.

Post operative radiographs were reviewed for evidence of radial length, radial inclination, dorsal tilt, communition. This information was entered into a Microsoft Excel database for statistical analysis [28].

INSTRUMENTS AND IMPLANTS REQUIRED

1. K wires 1.5 to 2 mm
2. power drill
3. k wire cutter
4. k wire bender
5. Plaster of paris 6 inches
6. soft roll

IMPLANTS REQUIRED



OPERATIVE PROCEDURE

Description :

Anaesthesia - Under supraclavicualar block anaesthesia,

Position – supine position with wrist over the arm table.

Step 1

The principle step is near anatomical reduction of the fractured fragments by closed reduction. Anatomical reduction is obtained by traction and counter traction decreasing impaction and aligning distal fragments by flexing the distal fragment in anteroposterior direction reducing the angulation upto neutal position and mediolateral displacements. The position is checked under c- arm control for acceptable levels [29].

Step 2

The final corrected position should have maintained radial length and radial inclination and this position is maintained before K wire application.

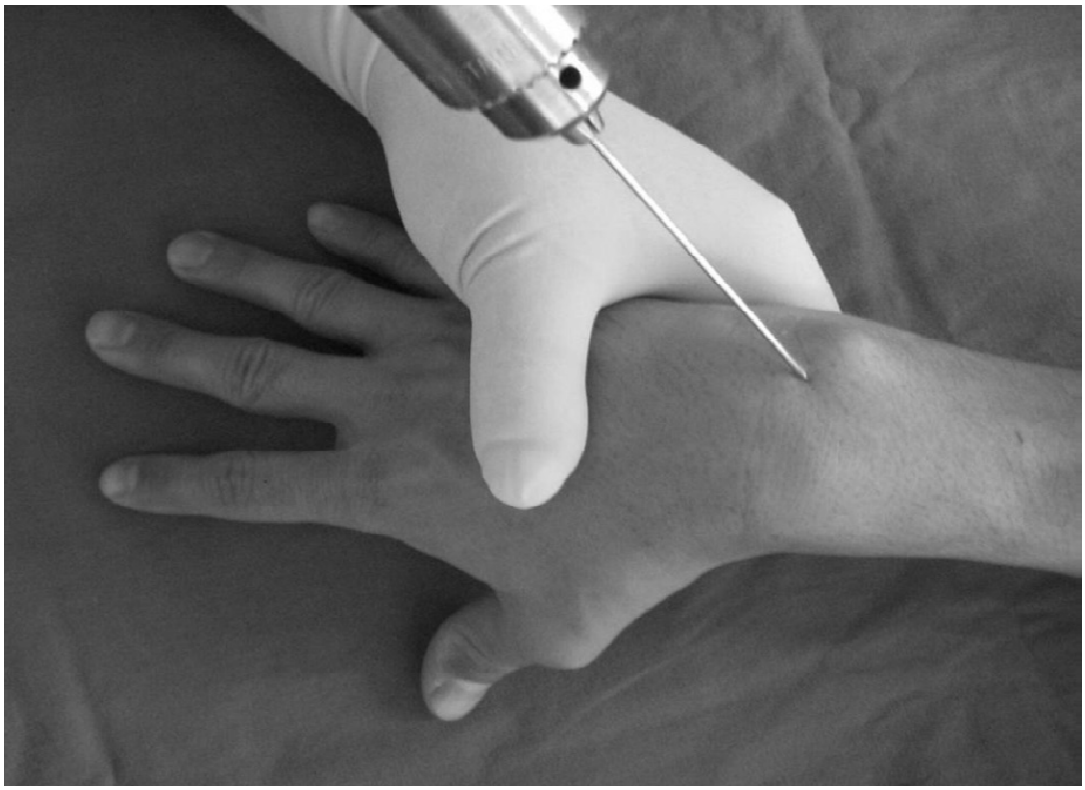
Step 3

After checking the position of reduction kuntshner wire of size 1.8 or 2 mm are inserted from lateral to medial starting from radial styloid process base crossing the fracture and holding the opposite cortex .with the assistant to maintain traction and reduction .

Usually power drill are used to apply k wires and not with hand drill[29] .

Step 4

Another k wire is inserted from the sigmoid notch starting dorsal cortex to the palmar cortex and to be sure that the kwire enters opposite intact volar cortex. And additional k – wires may be inserted from dorsal to volar to maintain stability.



Step 5

The reduction is checked under c – arm and the k –wires are bent at around 90 degree with k wire bender and cut with k wire cutter. Pin site sterile dressings and good adequate padding done with and plaster is then applied [29]

All steps are done under strict aseptic precautions and complete draping.

POST OPERATIVE PROTOCOL

The patients are regularly followed-up at our hospital at 2 weeks, 4 weeks and 6 weeks for assessing any pin site loosening or infection till pin removal [30].

The x rays were taken at periodic 2 weeks interval for assessing the radiological union. The patient were also assessed for clinical evidence of union and the possible wrist movements and the other radiological parameters.

The plaster of paris and percutaneous k-wires are usually removed after 6 weeks of immobilization under strict aseptic precautions[30] .

Patient are then mobilized for active and passive motion exercises and rehabilitation. Physical rehabilitation therapy is continued until the patient returns to his normal activities and regains a good hand grip.

The plasters are usually removed over 6 weeks. Most patients are recommended for the splint just for a protection[31].

RESULTS

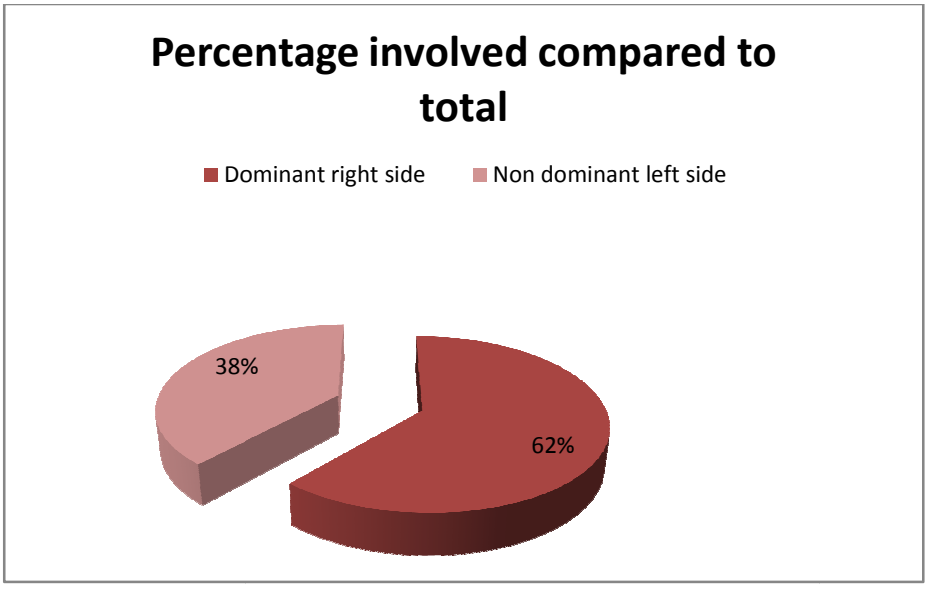
A prospective observational study was conducted on twenty five postmenopausal patients to analyse the functional outcome of percutaneous pinning and plaster with both intraarticular and extra articular distal radius fractures in Coimbatore medical college hospital for a period of one year between July 2014 to July 2015. In our study, the mean age of postmenopausal women was 57.6 years. The average follow up period was 6 months.

The results obtained from our study were analysed in many aspects with previous other similar observational studies and were postulated as follows.

SIDE PREDOMINANTLY AFFECTED

Among the total study sample of 13 women, Results showed that 8 postmenopausal women had sustained injury over the non dominant left wrist and the remaining 5 had sustained injury over the dominant right hand .All the women included in our study had right handed dominance.

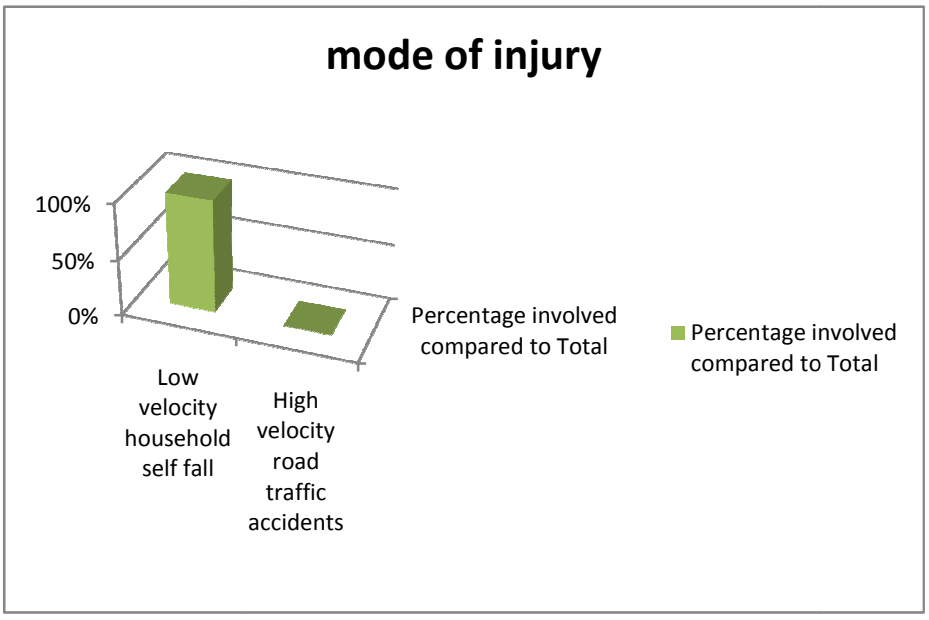
Involved side of injury	Percentage involved compared to total
Dominant right side	61.5 %
Non dominant left side	38.4%



MECHANISM OF INJURY

In our study series, it was found that majority of women sustained only a low velocity injury during the household activities. All the 13 postmenopausal women had self fall while doing household activities and no person had sustained violence by road traffic accidents.

Mode of injury	Percentage involved compared to Total
Low velocity household self fall	100%
High velocity road traffic accidents	0%

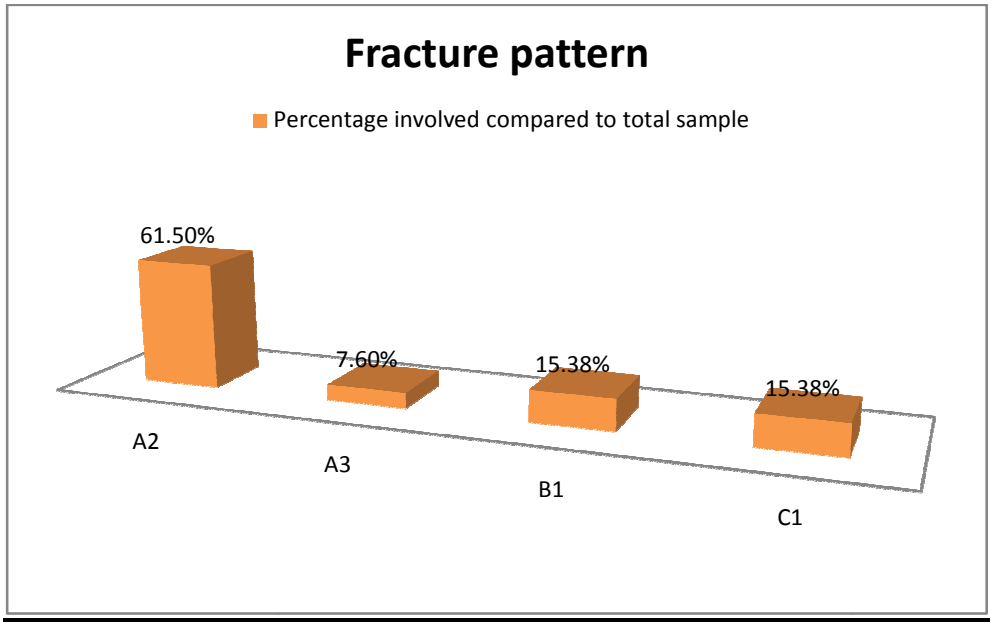


FRACTURE CLASSIFICATION

The classification followed for our study AO classification. In our study group, majority had sustained A 2 pattern of fracture.

The fracture types and the percentage of involvement are tabulated as follows.

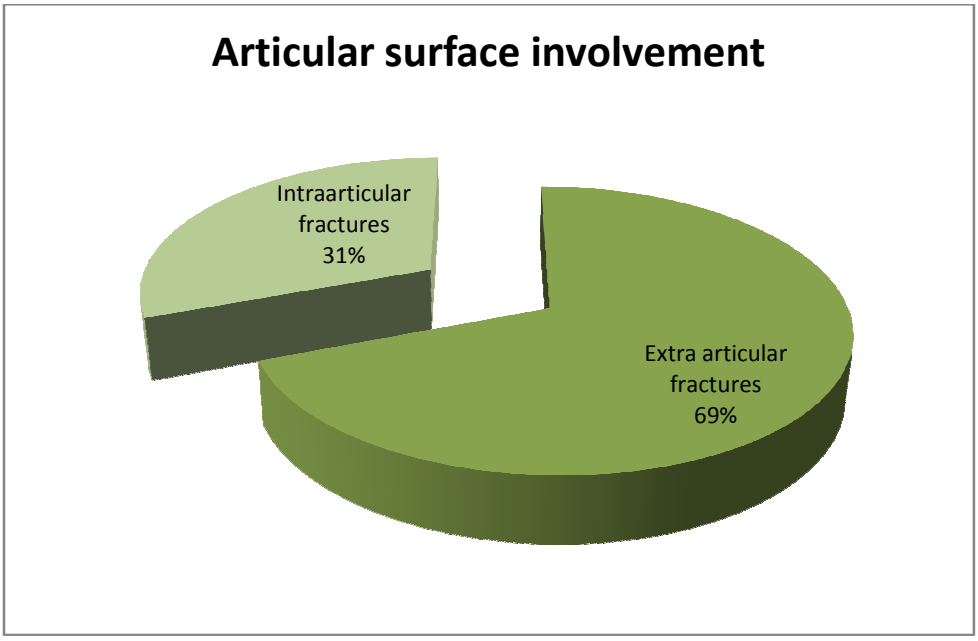
Fracture pattern	Total no.of cases	Percentage involved compared to total sample
A2	8	61.5 %
A3	1	7.6%
B1	2	15.38 %
C1	2	15.38%



ARTICULAR INVOLEMENT

In our study group of 13 patients, fifteen of the women had extra-articular metaphyseal fractures with dorsal displacement and only 5 with articular involvement.

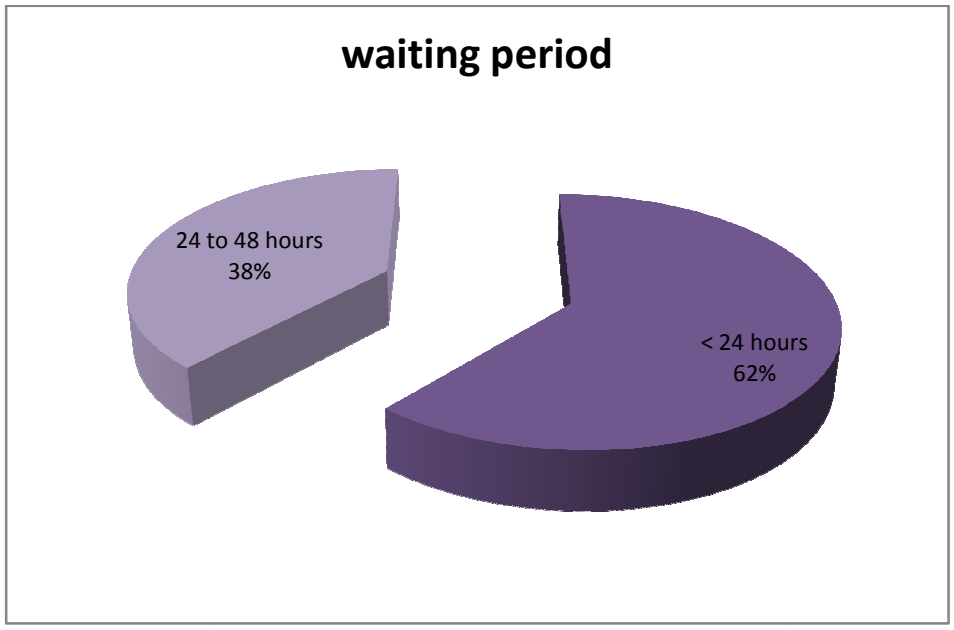
Fracture pattern	Total no. of cases	Percentage involved compared to total sample
Extra articular fractures	9	69.23 %
Intraarticular fractures	4	30.76%



SURGICAL WAITING PERIOD

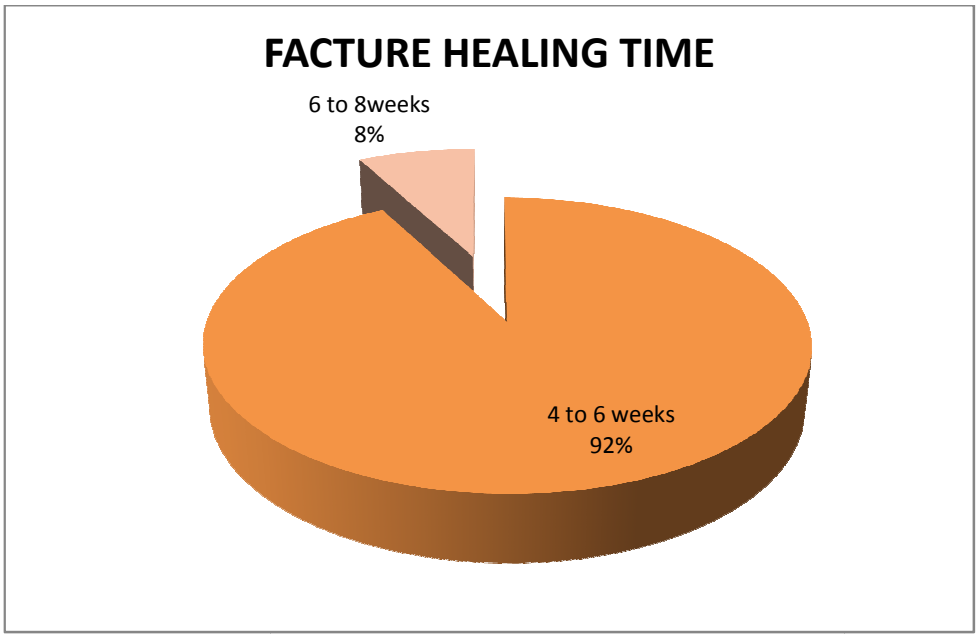
Most of the cases were taken up immediately for procedure within 24 hours. However 9 patients were taken up one day later.

Waiting period	No.of cases	Percentage involved compared to total sample
< 24 hours	8	61.5%
24 to 48 hours	5	38.4%



FRACTURE HEALING TIME

Average period of union	No. of cases	Percentage involved compared to total sample
4 to 6 weeks	12	95%
6 to 8weeks	1	5%



The average period of union in 95 % if women were around 4 to 6 weeks and 5% between 6 to 8 weeks. There was no cases of malunion or nonunion or delayed union in our series.

FUNCTIONAL RANGE OF MOVEMENTS

In our series of 13 patients who had follow up, 12 postmenopausal women had normal functional fexion and extension movements, 12 had normal radial deviation; 13 had normal ulnar deviation; 12 had normal supination and 12 had normal pronation and only 2 patients had overall reduced range of movements

Functional Range of motion	**No. of cases**
Flexion	12
Extension	12
Radial deviation	12
Ulnar deviation	13
Supination	12
Pronation	12

COMPLICATIONS

The main complications of our study was pin site infection with loosening and reduced range of functional motion. In my study one patient had reduced range of functional movements

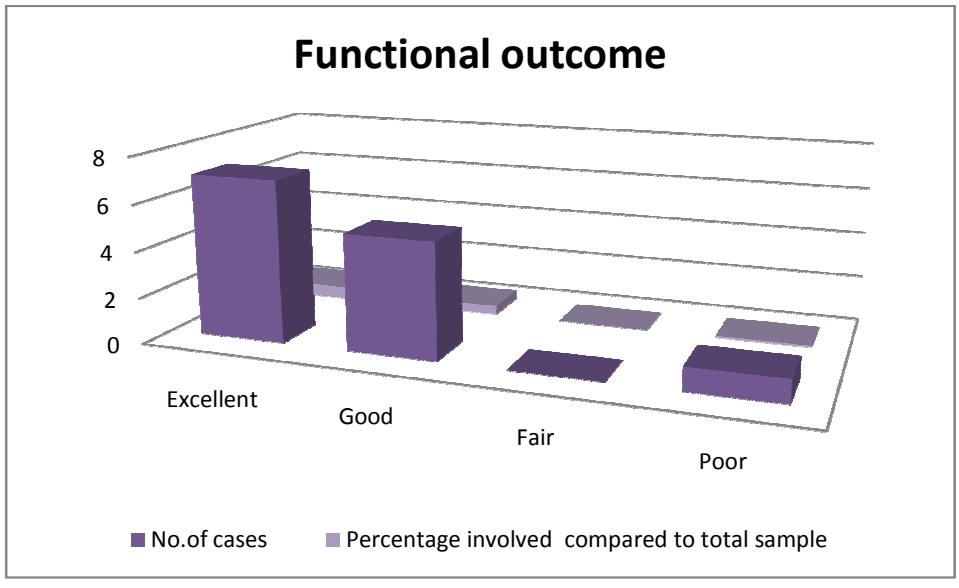
Complications	No. of cases	Percentage involved compared to total sample
Reduced functional range of motion	1	7.7 %

The overall total complication rate was 7.7 percentage.

MAYO FUNCTIONAL OUTCOME SCORING

The findings in our study was graded according to mayo wrist scoring system which included wrist pain, working status, functional arc of supination and pronation and power grip.

Functional outcome	No.of cases	Percentage involved compared to total sample
Excellent	7	53.8%
Good	5	38.4%
Fair	nil	0 %
Poor	1	7.7%



In our prospective study, we had excellent and good results in 92.2% women and poor results in 7.7% and no fair functional outcome .

DISCUSSION

The main aim of our study is to provide early functional range of wrists movements with quick return to daily activities and anatomical reduction with a simple day care surgical procedure. Considering the demands of the patients, percutaneous pinning and plaster is a better minimally invasive option over other surgical procedures. The patients were followed up with strict inclusion and exclusion criteria, hence the sample size was 13 patients. The kapandji technique was introduced in 1976 as intrafocal manouer.

The results of our study is compared with the publications and literectures and were discussed below.

SIDE PREDOMINANTLY AFFECTED

Results of our study showed that only 8 postmenopausal women had sustained injury over the non dominant left wrist and the remaining 5 had sustained injury over the dominant right hand.

In Uzzaman ks (2008), study results showed no difference in side of involvement. In Akhter Baig (2008) series of 33 patients, 18 patients had left side involvement and right side involved in among 15 patients. In RC Dirgha Raj (2011) series of 30 patients, 19 sustained left side and 11

had right sided fractures. In Cherian Jacob (2014) cohart study, 8 were right sided and 7 were left sided.

All the above literectures showed mainly left side side involvement which is similar to the results of our study.

MECHANISM OF INJURY

Almost 13 postmenopausal women had self fall while doing household activities and no person had sustained violence by road traffic accidents in our study.

In RC Dirgha Raj (2011) 25 patients had self fall and 4 with RTA. In Cherian Jacob (2014) study, 10 patients had sustained low velocity fall on household activities and 5 with high velocity RTA. In Akhter Baig (2008) series, self fall was mode of violence in 28 cases and remaining 5 cases had violence by RTA In T.Azzopardi study, all the 57 patients had sustained injury by self fall.

From the above study series showed that the major mode of violence is a low velocity fall the findings of which is consistant with our study.

FRACTURE CLASSIFICATION AND ARTICULAR INVOLEMENT

In our study group, majority had sustained A 2 pattern of fracture.

In Cherian Jacob (2014) cohart study of five pin technique, type A was found in 3 cases, type B in 3 cases and type C in 9 patients . In Akhter Baig (2008) series of 33 patients, all were AO classified type A extraarticular displaced unstable injuries. In RC Dirgha Raj (2011) series also all 30 cases were AO Type A fractures. In Uzzaman ks (2008) study, 23 were type A group and 17 were type C group frctures. In T.Azzopardi study of 57 patients all were type A extra articular fractures.

In a nutshell, majority of the studies of percutaneous pinning have been done in type a injuries. Our study have also showed Type A Predominance particularly Type A2.2 (typical colles fractures).

FRACTURE HEALING TIME

The average period of union in 92 % if women were around 6 weeks and 8% around 8 weeks in my series.

In T.Azzopardi study of 57 patients, the average period of fracture healing was 7 weeks. In RC Dirgha Raj (2011) series radiological union occurred by 6 weeks. In Akhter Baig (2008) series average fracture healing time was about 6 weeks.

Hence to conclude most of the series results had a fracture union around 6 weeks similar to my study results.

SURGICAL AND PLASTER COMPLICATIONS

In my study one patient had reduced range of functional movements and In T.Azzopardi study, one case had pin site infection. In Akhter Baig (2008) series of 33 patients, 17 patients had pin site infection, algodystrophy, stiffness of joint, pressure sore as complications. In RC Dirgha Raj (2011) series of 30 cases, one had RSD and 2 had pin site septic loosening .

FUNCTIONAL OUTCOME

In our study excellent results were seen in 53.8%, good outcome in 38.4 % and poor results in 7.7 % cases.

In RC Dirgha Raj (2011) series, 93% had excellent and good functional outcome and 7 % cases fair outcome.

In Akhter Baig (2008) series of 33 patients, showed excellent outcome in 21.2% cases, 75.8% with good and 3 % with fair outcome .

In Cherian Jacob (2014) study on 10 sample cases, excellent outcome group included 33.33%, good results in 60 % people and fair outcome in 6 .66% patients.

Thus the overall success results in our study was 92.2 % with good and excellent functional outcome at the final follow up.

CONCLUSION

Distal radius fractures are more common injuries occurring in geriatric population particularly among the postmenopausal women with underlying osteoporosis. The mode of violence is mostly a low velocity fall during the household activities. High velocity injuries are mostly encountered during road traffic accidents.

Majority of the fractures are said to be extra -articular displaced with dorsal angulation in postmenopausal women typical of colle's However, higher degree of violence may produce intra articular displaced and communited fractures.

The fracture union time on an average is found to be around 6 weeks. The anatomical reduction and radiological parameters are found to be obtained and maintained by crossed pinning providing a successful functional outcome and early range of motion in wrist joint.

Percutaneous pinning with k – wires are just a minimally invasive day care procedure meeting the patients demands . Percutanous pinning is a valuable procedure to prevent subsequent fracture secondary displacements with least complications. Further, the procedure is so economical and less time consuming and doesn’t need a longer learning curve compared other modalities of treatment.

The results of over study showed that proper reduction and positioning of k wire would provide a satisfactory outcome among the low demand groups.

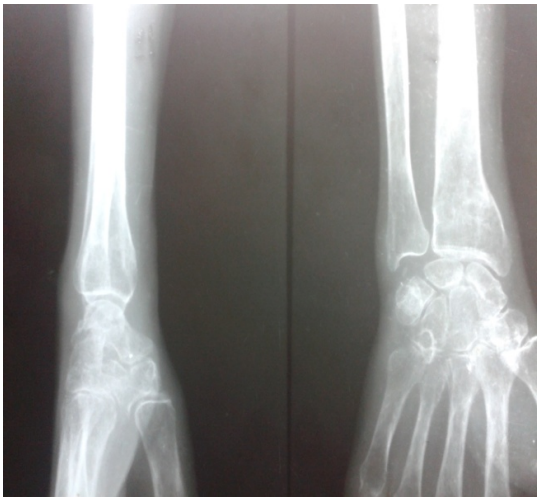
ANNEXURE I

CASE ILLUSTRATION

CASE 1 : ANGATHAL 65/F, IP NO 26461, WITH SELF FALL AND INJURY OVER RIGHT WRIST

PRE OP

IMMEDIATE POST OPERATIVE



FOLLOW UP XRAY

RANGE OF MOVEMENTS

PRONATION

SUPINATION

PALMAR FLEXION

DORSIFLEXION

CASE 2 ESAKIYAMMAL 49 /F IP NO 39876, WITH SELF FALL AND LEFT WRIST INJURY

PREOP

IMMEDIATE POST OP

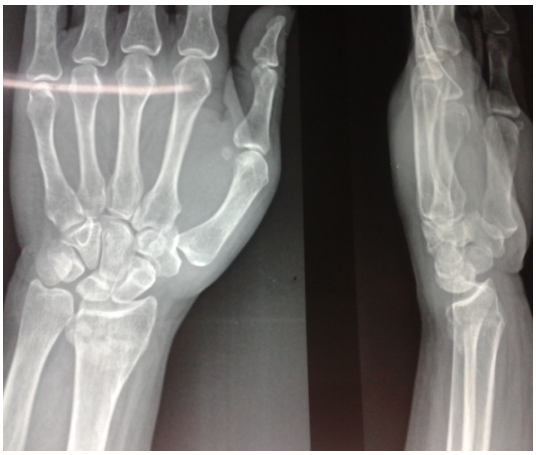
FOLLOW UP XRAY

RANGE OF MOVEMENTS

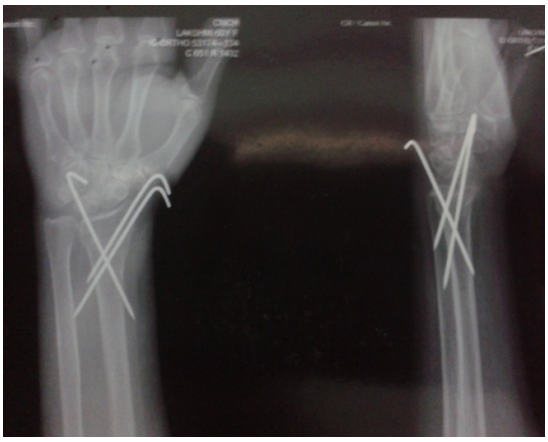
PALMAR FLEXION

DORSIFLEXION

CASE 3 : LAKSHMI 65 YRS /F , IP NO 53174 WITH SELF FALL AND INJURY OVER LEFT WRIST JOINT



PRE OPERATIVE



IMMEDIATE POST OP

FOLLOW UP XRAY

RANGE OF MOVEMENTS FOLLOW UP

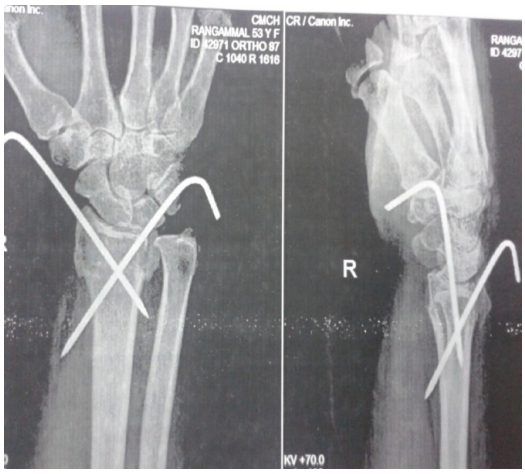
PRONATION

SUPINATION

PALMARFLEXION

DORSIFLEXION

CASE 4 : RANGAMMAL 53 YRS /F IP NO 42971 , WITH SELF FALL AND SUSTAINED INJURY OVER RIGHT WRIST



PREOPERATIVE X RAY **IMMEDIATE POSTOPERATIVE**

FOLLOW UP XRAY

RANGE OF MOVEMENTS

DORSIFLEXION

PALMAR FLEXION

SUPINATION

PRONATION

ANNEXURE II

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ANNEXURE III

PROFORMA

Patient Details

Patient Name Female	Age :	Sex :
Occupation :		
Address :	Contact No :	
OP No/ IP No :		
Unit :	Head :	
DOA :	DOS :	DOD :
Clinical History : Presenting Complaints : Mode of injury :		

Clinical Evalution:

Pre injury status And Co morbidities :

Obesity :

Diabetes :

Hypertension :

Menopause :

CVS :

RS :

CNS :

Psychiatric illness :

Heart diseases :

Background Data

Substance abuse :

Drug Intake :

Associated injuries

Head injury :

Chest injury :

Other fractures :
If any

Local examination

Wrist region :

Open / closed injury

Skin condition

Deformity

Radiological Evaluation :

x-ray wrist (affected side)
AP view :

Lateral view :
x-ray chest AP view :

Distal radius :

Fracture pattern :
[AO classification]

Diagnosis :

Plan :

Anaesthesia

Operative technique

Position :

Duration of Surgery :

Post-Operative :

Duration of Antibiotics :

Post OP Evaluation :

Clinical :

Fever :	Pain :
Pin track infection :	Swab for C & S in case of infection :
Neurovascular injury :	active finger movements :
Rotational deformity :	

Radiological evaluation :

Complications :

3 RD WEEK	Date :
Pin site infection :	
Radiological evaluation : Radial height :	
Radial inclination :	
Dorsal angulation :	
Palmar Tilt :	
Advice	Professor

6TH WEEK	Date :
Clinical status :	
Radiological evaluation : Radial height :	
Radial inclination :	
Dorsal angulation :	
Functional mayo score :	
Advice :	
professor	

3 RD MONTH	Date :
Clinical status :	
Radiological evaluation : Radial height :	
Radial inclination :	
Dorsal angulation :	
Functional mayo score :	
Advice :	
professor	

6TH MONTH Date :

Clinical status :

Radiological evaluation : Radial height :

Radial inclination :

Dorsal angulation :

Functional mayo score :

Advice :

professor

ANNEXURE – IV

ஒப்புதல் படிவம்

பெயர் :

வயது :

பாலினம் :

முகவரி :

அரசு கோவை மருத்துவக் கல்லூரியில் எலும்பு மற்றும் முட்டு அறுவை சிகிச்சை துறையில் பட்ட மேற்படிப்பு பயிலும் மாணவர் **வி.அஜய் கார்த்திக்** அவர்கள் மேற்கொள்ளும் ***"FUNCTIONAL OUTCOME OF DISTAL RADIUS FRACTURES WITH PERCUTANEOUS PINNING AND PLASTER IN POSTMENOPAUSAL WOMEN***" பற்றிய ஆய்வியல் செய்முறை மற்றும் அனைத்து விளக்கங்களையும் கேட்டுக் கொண்டு எனது சந்தேகங்களை தெளிவுபடுத்திக் கொண்டேன் என்பதை தெரிவித்துக் கொள்கிறேன்.

நான் இந்த ஆய்வில் முழு சம்மதத்துடனும், சுய சிந்தனையுடனும் கலந்து கொள்ள சம்மதிக்கிறேன்.

இந்த ஆய்வில் என்னைப் பற்றிய அனைத்து விவரங்கள் பாதுகாக்கப்படுவதுடன் இதன் முடிவுகள் ஆய்விதழில் வெளியிடப்படுவதில் ஆட்சேபனை இல்லை என்பதை தெரிவித்துக் கொள்கிறேன். எந்த நேரத்திலும் இந்த ஆய்வில் இருந்து நான் விலகிக் கொள்ள எனக்கு உரிமை உண்டு என்பதையும் அறிவேன்.

இடம் :

தேதி :

கையொப்பம் / ரேகை

ANNEXURES V

ABBREVIATIONS

BMD	-	Bone mineral density
CRPS	-	complex regional pain syndrome
DRUJ	-	distal radioulnar joint
DF	-	dorsiflexion
ORIF	-	open reduction and internal fixation
OTA	-	orthopaedic trauma association
P	-	pronation
PA	-	palmar angulation
PF	-	palmar flexion
POP	-	plaster of paris
PT	-	palmar tilt
RA	-	radial angulation
RD	-	radial deviation
S	-	supination
TFCC	-	triangular fibrocartilagenous complex
UD	-	ulnar deviation
UV	-	ulnar variance

MASTER CHART

S.NO	NAME	AGE (YR)	SIDE	MODE OF INJURY	AO FRACTURE TYPE	WAITING PERIOD DAYS	FOLLOW UP DURATION	RADIAL LENGTH (mm)	RADIAL INCLINATION (Degree)	PALMAR TILT (Degree)	DORSAL ANGULATION (Degree)	PF	DF	S	P	RD	UD	COMPLI CATION	MODIFIED MAYO SCORE	RESULTS
1	RAJAMANI	51	L	FALL	A2.2	NIL	4 MONTHS 2 WEEKS	9	19	9	0	80	85	90	90	25	30	NIL	90	EXCELLENT
2	RABIYA	54	L	FALL	B1.1	NIL	4 MONTHS	11	22	11	0	80	85	85	90	20	25	NIL	100	EXCELLENT
3	RANGAMAL	53	R	FALL	A2.2	NIL	3 MONTHS	8	20	9	0	75	80	75	80	15	20	NIL	85	GOOD
4	ANGATHAL	65	R	FALL	A2.2	NIL	5MONTHS 2 WEEKS	11	24	9	0	75	80	75	80	20	25	NIL	85	GOOD
5	PUSHPA	47	R	FALL	A2.2	NIL	4MONTHS 2 WEEKS	9	19	9	0	80	80	85	90	25	20	NIL	95	EXCELLENT
6	KAMALA	55	L	FALL	C1.3	NIL	5MONTHS	10	22	8	0	80	80	80	85	20	30	NIL	90	EXCELLENT
7	MANIKAM	55	L	FALL	C1.3	1	4MONTHS 2 WEEKS	9	2O	8	0	80	75	75	80	15	20	NIL	85	EXCELLENT
8	BAGAVATHI	65	L	FALL	A2.2	1	4 MONTHS 2 WEEKS	8	17	8	0	35	45	50	50	10	10	REDUCED ROM	65	POOR
9	SENBAGAVALLI	49	R	FALL	A2.2	1	13 MONTHS	8	19	9	0	75	80	70	80	15	20	NIL	80	GOOD

S.NO	NAME	AGE (YR)	SIDE	MODE OF INJURY	AO FRACTURE TYPE	WAITING PERIOD DAYS	FOLLOW UP DURATION	RADIAL LENGTH (mm)	RADIAL INCLINATION (Degree)	PALMAR TILT (Degree)	DORSAL ANGULATION (Degree)	PF	DF	S	P	RD	UD	COMPLI CATION	MODIFIED MAYO SCORE	RESULTS
10	ARRUKANI	50	R	FALL	A2.2	1	5MONTHS 3WEEKS	9	19	9	0	80	75	80	80	20	25	NIL	80	GOOD
11	PUSHPA	54	R	FALL	B1.1	NIL	8 MONTHS	10	21	9	0	75	85	85	85	20	25	NIL	90	EXCELLENT
12	LAKSHMI	65	L	FALL	A2.2	1	13 MONTHS	9	21	9	0	85	80	90	90	25	30	NIL	95	EXCELLENT
13	ESAKIYAMMAL	49	L	FALL	A2.2	1	3MONTHS 2 WEEKS	11	20	8	0	80	80	85	85	20	25	NIL	85	GOOD